APPLIED RESEARCH REPORT

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COPY

THE ROLE OF MINERALS AND PARTICLE SIZE IN COMBUSTION OF CANADIAN BITUMINOUS COALS:

FINAL REPORT
DSS Contract No. 0SQ85-00214

"MINERAL MATTER SPATIAL DISTRIBUTION
IN COAL AS RELATED TO SLAG POTENTIAL
AND MICRONIZING TECHNIQUES IN
COAL COMBUSTION"

by:

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Project: ACI-85-197
Date: August 1986

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SUMMARY CONCLUSIONS

The mineralogy and chemistry of two Canadian Bituminous coals has been investigated at three particle sizes: -20 mesh crush, 200 - 400 mesh sieve fraction and -400 mesh sieve fraction as follows:

1. Balmer Seam (Sparwood, B.C.)
2. Hub Seam (Prince Mine, Nova Scotia)

The major minerals in Western coal are: kaolinite, illite and quartz. Minor minerals are siderite, apatite and traces of calcite, ankerite, rutile, monazite, zircon, sphalerite, and chalcopyrite. The Eastern coal carries major minerals pyrite, kaolinite, illite and quartz. Trace minerals include all of the previous list, plus gypsum, halite and dolomite. A sulphur depleted iron sulphide or sulphate is present as well as an unidentified silicate (staurolite?).

Particle size distribution of these minerals is strongly affected by sieve separation after comminution of the coal. A skewed distribution biased towards small grains for each size fraction is indicated. The mineral inclusions are substantially smaller than coal host for the -20 mesh coal, but have been liberated from their maceral matrix for the pulverized and micronized material. The -400 mesh sieve fraction is dominantly sub-micronized (<1 micron diameter) and is below the resolution of backscatter electron imaging.

Mineral transformations during combustion were investigated for each size fraction. Major minerals survive combustion at 850 and 1100°C except for the dehydration of clays and decomposition of pyrite. New mineral phases appear which may reflect mineral reactions (e.g. $CaSO_4$) or may be due to elements released by the burning macerals (trace elements, organic S. No significant difference was seen in the use of oxidizing or reducing environments in our experimental set-up.

To interpret the foregoing data on Canadian bituminous coals, the published world literature was reviewed and summarized. Several laboratory techniques used by other investigators should be evaluated to better model the combustion characteristics of Canadian pulverized coals.

Laboratory furnace tests can reproduce some of the mineralogical and textural products of pulverized fuel combustion. However, the many factors that control mineral transformations and ash production require tests beyond the scope of the present study. Rock-Eval pyrolysis is a new technique that shows promise in characterizing combustion of small samples and in reflecting the influence of rank and mineralogy.

August 8, 1986

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ACKNOWLEDGEMENTS:

The initial work benefited from the project design of Dr. Patrick Fung. Laboratory combustion tests and ASTM analyses were partially conducted by Donna C. McMahon, Robert O'Donnell and Alex Dove. Financial and word processing aspects were handled by Helen Costello.

We acknowledge the assistance of Dr. J.A. MacPhee in supplying the size-fractioned samples as well as some bulk chemical data. His visitations to our Sydney laboratories and project support as Scientific Authority are also appreciated.

RECOMMENDATION:

1. The financial scope of this project did not allow for a full investigation of all parameters influential in pulverized coal combustion. Combustion test methods were too simple to correctly model free-falling coal particles in a utility boiler.

2. Pulverized coal should be investigated without sieve fractionation. Micronized coal, with a mean diameter of 5 microns should be prepared using comminution techniques appropriate for industrial application on whole coal.

3. The two coals investigated are not necessarily representative of their respective mining operations. The Prince coal was cleaner than expected. Thermal coals with higher ash and sulphur should be investigated, bypassing the wash plants.

4. A laboratory furnace assembly should be constructed allowing accurate reproduction of the "free-fall" temperature environment of pulverized fuel combustion. Published methods are available.

5. Rock-Eval pyrolysis should be further investigated as a rapid technique for coal characterization under different atmospheres. Residues should undergo SEM-EDX evaluation.

6. A comparison should be made, of the morphology and mineralogy of fly ash and bottom ash from various Canadian utility boilers. This data should be correlated to the mineralogy of various coal seams to identify slagging, fouling and pollution, as well as suitable methods of ash disposal. Canadian fly ash should be classified by an international scheme.

7. The automated particulate analysis procedure used here, should be applied to the quantitative analysis of all Canadian coals of economic interest. Particulate chemistry and size data should be correlated to similar data from utility fly ash and slag.

TABLE OF CONTENTS

PAGE

Summary Conclusions 1
Recommendations 3
Table of Contents
Contract

Technical Programme 6

- A. Samples 6
- B. Geology 7
- C.Sample Preparation 8
  1. Low Temperature Ash
  2. Leucite Pellet Mounts
  3. Cold-mount Pellets
  4. Particulate Mounts
  5. Carbon Coating
- D. Petrographic Analysis 11
  1. Group Maceral Analysis
  2. Vitrinite Reflectance
- E. Chemical and Mineralogical Analysis 12
  1. Weight % Ash in Coal
  2. Sulphur Analysis
  3. Xray Diffraction
- F. Combustion Tests 15
- G. Pyrolysis Tests: Rock-Eval 16
- H SEM-EDX-AIA 18
  1. Scanning Electron Microscopy
  2. Energy Dispersive Xray Microanalysis
  3. Automated Particulate Analysis

Mineralogy and Coal Combustion: Literature Review 22
Introduction
Particulate Combustion
Particle Size Factors
Minerals in Coal
Ash Tests
Characterizing Fly Ash
Mineral Transformations
Pulverized Coal: Simulated Combustion
Rock-Eval Pyrolysis
Automated Particle Analysis
Previous Work: Western and Eastern Canadian Coals

Table of Contents con't...

Interpretation of Results 43
Introduction
Bulk Characteristics: Eastern Canadian Bituminous
Bulk Characteristics: Western Canadian Bituminous
Coal Mineralogy and Morphology:
    Hub Seam (P743)
    Balmer Seam (P587)
Coal Ultrafines: -400 mesh
Automated Particulate Analysis
    Balmer Seam (P587)
    Hub Seam (P743)

LIST OF TABLES

1. Mineral distribution in pulverized coal

2. Mineral melt temperatures versus coal combustion conditions

3. SEM-EDX observations on coal fly ash

4. Fly-ash terminology

5. Porosimetric data

6a. Typical Eastern Canadian bituminous coals

6b. Rock-Eval Pyrolysis and Elemental Analysis

7. Typical Western Canadian bituminous coals

8. Minerals in Balmer Seam (P587)

9. Minerals in Hub Seam (P743)

10. Minerals in Ash: Balmer Seam (P587)

11. Minerals in Ash: Hub Seam (P743)

LIST OF FIGURES

1. Factors influencing ash characteristics

2. Particle size distributions for fly ashes and bottom ashes

3. Schematics of ash-particle formation and deposition mechanisms

4. (a) Normal build-up of gas-side fouling from flue gas constituents

   (b) Parameters influencing slagging, fouling and corrosion in coal-fired boilers

5. Fly ash morphogenesis scheme

6. (a) Enrichment factors of various elements in fly-ash as related to concentrations in coal

   (b) Estimated polycyclic aromatic hydrocarbon (PAH) concentrations in coal ash

7. (a) Triangular graph for coal fly ash classification

   (b) Fly ash groups

   (c) Summary of nomenclature

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MINERAL MATTER SPATIAL DISTRIBUTION IN COAL AS RELATED TO THE SUITABILITY OF MICRONIZING TECHNIQUES IN COAL COMBUSTION

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APPENDIX "A"

STATEMENT OF WORK

Background

In pulverized fuel fired combustion systems the production of fly ash species may produce deposits on the heat absorbing surfaces resulting in the loss in thermal efficiency. It has been shown by research at Foster Wheeler Energy Corp. [1] that the size distribution of the mineral matter in the fuel is an important factor in the deposition tendency of the ash. That is, the more finely disseminated the particles (pyrite in particular) the greater the deposition potential. To date, study of coal in this respect has been by sink - float techniques with whole coal. Recent pilot-scale demonstrations have indicated that micronizing of coal (grinding to <10 microns) reduces the deposition potential of a given coal compared to that observed when the coal is pulverized (90 wt% <75 microns). Raask[2] has shown that there is negligible interaction between ash particle after formation and therefore the nature of the particles must be determined by the mineral matter within the coal particle during combustion.

The objective of this study is to determine the mineral matter associated with carbonaceous material in two ranks of coal. The coals will be studied in three size ranges: standard ASTM petrographic, pulverized and micronized. The size necessitates the use of both optical and electron microscopic techniques (scanning and transmission). The ranks of coal are an eastern bituminous and a western medium volatile bituminous.

TECHNICAL PROGRAM

A. SAMPLES

The Atlantic Coal Institute received samples on December 3, 1985, from the Energy Research Laboratories of the Canada Centre for Mineral and Energy Technology (CANMET), Ottawa. The collection date was unknown; and all comminution and splitting was previously conducted by CANMET.

The samples were collected as wash products from commercial coal wash plants. Comminution was performed by standard mechanical mill (propeller blade type). A -20 mesh split represented the whole coal, while -200 and -400 mesh splits represented sieve fines recoveries (200 - 400 mesh and < 400 mesh particle size).

The following samples formed the basis of our study (Project 85-197):

1. Eastern Canada high volatile bituminous coal: Hub Seam (washed) Prince Mine, Point Aconi, Nova Scotia.

CANMET #	OUR #	MESH SIZE	WEIGHT
P743	85-197-A-20	-20	50 g
P743	85-197-A-200	-200	1.4 g
P743	85-197-A-400	-400	1.48 g

2. Western Canada, medium volatile bituminous coal: Balmer Mine, Sparwood, B.C.

CANMET #	OUR #	MESH SIZE	WEIGHT
P587	85-197-B-20	-20	50 g
P587	85-197-B-200	-200	--
P587	85-197-B-400	-400	--

B. GEOLOGY

The Western Canada coal came from the Balmer Operations of Westar Mining Ltd. near Sparwood, British Columbia. These coal measures are part of the East Kootenay Coal Field, of Lower Cretaceous age, interbedded with sandstones, mudstones, shales and conglomerates over a 665 m stratigraphic section. The coal quality varies considerably from seam to seam because of lensoid deposition and ash and maceral composition, but the Balmer Seam (#10 Seam) is relatively uniform (Hale, 1985). The actual source of our washed sample is unknown.

The Eastern Canada coal is a Hub Seam sample from the Prince Mine, operated by the Cape Breton Development Corporation, Point Aconi, Nova Scotia. Retreat longwall mining is carried out 550 feet below Sealevel on a nine foot seam to produce thermal coal averaging 12% ash and 3.5% sulphur (MacLean, 1985).

At the Victoria Junction coal preparation plant, coal is crushed to -1 1/2 inches and processed through heavy media cyclones and froth flotation cells to produce metallurgical coal (3.0% ash, 1.2%S) or thermal middlings.

The Hub Seam is part of the Morien Group of Carboniferous sediments forming the submarine "Sydney Basin". This is a paralic basin with terrestrial sediments including normal-banded autochthonous coals (Hacquebard, 1979).

Coal quality is controlled geologically by seam-splitting and during mining by dilution from roof-rock and undershales.

C. SAMPLE PREPARATION

The limited sample quantity put restrictions on sample preparation in order to maximize the possible number of tests. Because a washed coal yields less than 15% ash and because mineral concentration is necessary for bulk techniques such as XRD, more emphasis was placed on microtechniques such as SEM-EDX-AIA and optical petrography.

1. Low Temperature Ash (LTA)

Splits from the -20 mesh whole coal were subjected to low temperature plasma ashing (LTA) to isolate the unaltered minerals by the techniques of Gluskoter (1965). For this we used an SPI Plasma Prep II from Structure Probe Inc. (U.S.A.) operated at 80 watts. Some 10 grams were ashed over a period of 10 days each. This material yielded enough LTA ash for semi-quantitative XRD. Insufficient sample material was available to consider LTA and XRD analysis for the -200 and -400 mesh fines.

2. Leucite Pellet Mounts

Coal pellets were prepared from splits of the -20, -200 mesh coal in accordance with ASTM method D2797-72. Each sample was mounted as a 25mm pellet with acrylic leucite transoptic powder in an automatic Metaserv mounting press. The resultant coal pellets underwent three grinding stages using 240, 400 and 600 grit adhesive backed grinding papers attached to Metaserv grinding laps. This was followed by two polishing stages: first with polishing cloth and 0.3um alumina powder suspended in distilled water, followed by double-layered silk and 0.05um alumina powder. This procedure results in a fine polished surface suitable for microscopic examination of both the organic macerals and inorganic minerals with either reflected light or backscatter electron microscopy (after carbon coating).

Coal slag and fly ash from the combustion experiments were mounted with the same procedure but presented some difficulties. The friable and porous nature of the combustion residues caused plucking during grinding and acted as trap for the alumina powder.

The -400 mesh coal was not amenable to pelletization because particle size was less than that of the leucite powder. Therefore, several alternate mounting methods were explored for these fines, including a cold resin slurry method.

3. Cold-mount pellets

A liquid polyester resin (Resin SW, from Metallurgical Services Laboratories Ltd., Betchworth, England) was used to form slurries with the micronized and pulverized coal samples. The slurry was poured into 25mm molds, degased under vacuum for five minutes, and 1.25% organic peroxide hardener was added (5 drops per 20ml. resin). After 15 hours of hardening time, the resultant pellet was polished by the standard ASTM petrographic procedures.

4. Particulate Mounts

Particle morphology and qualitative chemistry by SEM-EDX can be obtained from direct particle mounts onto a suitable substrate. Several methods were investigated:

a. Fragments of coal fines or ash were anchored on a 1mm diameter carbon stub using carbon paint.

b. A spatula of coal fines or ash were scattered onto a Nuclepore filter (0.2 micron pores, Nuclepore catalogue 110605).

c. Fisher brand 2-Propanol and an ultrasonic bath was used to disperse coal fines in solution, for droplet deposition on a gold coated glass cover slip.

d. The 2-Propanol dispersant was dropped onto a Nuclepore filter and mouned to a 1" carbon planchette using vacuum grease.

5. Carbon Coating

All of the above pellet and particulate mounts (except for the gold-coated glass) were carbon coated using a filament-type Polaron Sputter Coater. Two filaments were required per set of samples and sample heating was minimized with a refrigerated platform.

D. PETROGRAPHIC ANALYSIS

1. Group Maceral Analysis

The three principle maceral groups in coal are: exinite, vitrinite, and inertinite. These maceral groups can be subdivided into a number of macerals as illustrated in Appendix Table 5, following international terminology (Bustin *et al* 1983).

The point count method (ASTM D2799-72) was used by attaching a Swift point counter and automatic stage to a Zeiss Universal petrographic microscope. Maceral determinations were made on the -20 mesh coal samples at 500X under immersion oil ($n^{25} = 1.5150$). A corss-hair graticule was used for maceral counts. Traverses were made across the polished leucite pellet at 0.5mm increments, with 0.5mm point to point distance. A total of 500 points counted for each coal pellet, yielded the volume percents recorded in Table 3 and 4, Appendix 1.

2. Vitrinite Reflectance

Vitrinite reflectance determinations were made on the whole coals in accordance with ASTM method D2798-72 using a Zeiss Universal petrographic microscope equipped with photometer and digital photomultiplier indicator. A monochromatic filter which passes light of 546nm wavelengths was mounted between the sample and photometer. The readings were taken on small areas of vitrinite. The stage was rotated 360°, and the maximum reading was recorded ($R_{o\ max}$). For each sample, a total of 50 vitrinite grains were identified and measured for reflectivity, to obtain a statistical assessment of the maximum. Histogram plots of maximum reflectance readings are found in Appendix Figures 1 and 2, Appendix I. Data Table 5, Appendix I contains a listing of measured values for each sample.

E. CHEMICAL AND MINERALOGICAL ANALYSIS

1. Weight % ash in coal

The ash yield from whole coals was measured using -20 mesh samples comminuted to ASTM procedures (-60 mesh). A Fisher Model 490 Coal Analyser was used following standard methodology. Approximately 1 gram of -60 mesh coal was weighed into a fused quartz crucible to the nearest 0.1mg. The coal was placed in a cold muffle furnace and heated to 500°C at the rate of 10° per minute. The sample was further heated to 750°C at a rate of 12°C per minute and maintained at 750°C for four hours until a constant weight was reached. The percent ash was calculated from the difference in the weight of the coal and the weight of the final ash product (Table 1 Appendix I).

2. Sulphur analysis

The total sulphur content of the coal was determined using a Leco Model 521 Induction Furnace. A 0.1 gram sample of -60 mesh coal was burned in a combustion tube, and the SO_2 gas yielded on combustion was retained in a dilute HCl solution. The solution was titrated to endpoint using KIO_3 with a starch indicator. The sulphur content (Table 1, Appendix 1) was calculated using the following equation:

$$\%S = \frac{A}{B} \times K$$

where:
A = mls iodate (KIO_3)
B = weight of coal in grams
K = determination factor (constant)

3. Xray diffraction

Much of the recently published information regarding minerals in coal is derived from Xray diffraction analysis of low temperature ash (Mraw et al., 1983). The interpretation of such xray diffractograms on LTA may, however, be misleading for several technical reasons (Mraw et al., 1983; Finkelman and Gluskoter 1981; Jenkins and Walker, 1978).

Quantitative XRD analysis of LTA is very difficult to achieve because of the following factors:

1. Adsorption coefficients of minerals
2. Grain orientation of platey minerals
3. Heterogeneous mixtures of variable particle size
4. Calibration curves of mineral standard mixtures not always linear.
5. Overlapping peaks.
6. Low peak/background ratios

Xray Assay Laboratories Limited (Don Mills, Ontario), the subcontractor, uses the following operating procedures for semiquantitative analysis:

1. Powdered sample is hand ground in an agat mortar to -200 mesh without dilution.
2. Powder is mounted in a standard Philips holder and flattened with a glass sheet.
3. Xray diffractograms are obtained via a Philips 1710 unit operated at 40kv and 40ma using a cobalt tube.
4. Mineral identification is manual via the JCDS file.

According to Hutchison (1974), a Co Xray tube gives better peak resolution than CuK radiation and is especially preferred for minerals high in iron. Nevertheless, Kirkert and Brandt (1981) and Jenkins and Walker (1978) recommended CuK radiation for LTA from coals. The selection of parameters by XRAL was dictated by the bulk of their contract work involving silica on silver membranes. We are not in a position to assess fully the significance of their operating conditions on our results.

Table 2 (Appendix I) gives XRD results on the two -20 mesh coal samples after low temperature ashing. The wide range of concentrations and limited mineralogy reported, make this technique inappropriate for further consideration. Other reservations to the interpretation are offered as follows:

1. "Kaolinite" should read "clays" since no glycolation or heating procedures were applied. Therefore, illite may be a contributor.

2. Pyrite estimates are likely incorrect because of oxidation losses and illite interference.
3. The unidentified "mineral" is not considered "minor" if present for 10% of the volume.
4. No trace minerals are recognized.

No further interpretation of this data will be made.

F. COMBUSTION TESTS

To approximate mineral transformations in pulverized coal combustion, we selected a simple crucible technique to ignite particles in a laboratory muffle furnace, under both oxidizing and reducing conditions.

A reducing atmosphere was created with 40% CO_2 - 60% CO gas mixture from Liquid Carbonic Inc. fed into the furnace assembly via a stainless steel tube. Oxidizing atmosphere was insured by a positive pressure of air via the same tube assembly.

Vitreosil crucibles (translucent, glazed, 99.8% silica), resistant to 1050°C, were preheated in Thermolyne type 105500 muffle furnace operated at 850°C or 100°C settings. A small spatula of coal (-20, -200, or -400 mesh) was rapidly dropped from a height of approximately 5cm., into the glowing hot crucible. After durations of 3 to 10 seconds, the crucibles and ash were removed and cooled in an argon-purged dessicator.

When cooled, the resultant ash was viewed by scanning electron microscopy as particulate mounts or polished leucite pellet mounts.

In view of the literature evidence of complex factors affecting coal combustion, the present laboratory procedure is considered primitive. A more elaborate experimental methodology was beyond the financial and time constraints of the project. Future tests should utilize a vertical furnace and gas injection system similar to the work of Sarofim et al (1977) and Mims et al (1980).

The ash produced from this laboratory simulation is best compared to bottom ash from utility boilers, although the free-fall injection method may have created components and textures similar to fly ash.

G. PYROLYSIS TESTS: ROCK-EVAL

Although this contract did not call for pyrolysis tests, the availability of a new "Rock-Eval Oil Show Analyser" by Delsi Instruments (France), allowed some preliminary runs to assess its usefulness. The technique is described elsewhere (Peters, 1986).

Some 15mg of -200 mesh, or finer, coal is weighed in a stainless steel crucible with sieve cap and bottom. Samples are purged with helium for two minutes at 90°C to release free gaseous hydrocarbons (S_0 peak). The crucible is then raised into a pyrolysis oven at 300°C to release liquid hydrocarbons (S_2 peak). After two minutes, a temperature gradient of 30°C/minute is applied up to 600°C for the thermal cracking of solid organic matter (kerogen) to yield the S_2 peak. The crucible is then transferred automatically to a second oven for oxidation in air at 600°C for five minutes. This yeilds the S_4 peak for calculation of T.O.C. The S_0 to S_2 peaks are detected via an F.I.D. using helium as carrier gas. The S_4 peak (CO_2) is detected via a T.C.D. unit with air as carrier. T_{max} is the temperature at maximum pyrolysate yield of peak S_2. Hydrogen Index is calculated from the equation:

$$\frac{S_2}{T.O.C.} \times 100 \qquad \text{mg hydrocarbons/g T.O.C.\%}$$

The pyrolysis results are compared to a calibration standard. Our in-house standard is an oil shale yielding an S_2 of 15.02 mg/g.

H. TECHNICAL PROGRAMME : SEM-EDX-AIA

1. Scanning Electron Microscopy:

Pulverized coal and ash particles were best viewed for morphology, as carbon-coated mounts on aluminium or carbon SEM stubs and nuclepore filters, imaged by secondary electrons (SEI). We used a Jeol T300 scanning electron microscope, operated at 20 Kv using a 20 mm working distance and a eucentric stage. Photomicrographs were obtained at various magnifications (35x to 3500x) from a 2000 line resolution CRT on 4"x5" Polaroid PN55 film using 90 second exposures. Under optimum conditions, an image resolution of 6 nm is possible.

Polished leucite pellet mounts were used for mineralogical information obtained with an annular-type backscattered electron detector (BEI). At 20 Kev, macerals and resin show as low contrast background, while minerals "glow" as bright grains on a dark field. Relative brightness is proportional to the heaviest element present. Resolution in BEI is not as good as for SEI but can discern minerals down to 0.1 micron diameter.

2. Energy Dispersive Xray Microanalysis:

Major element chemistry of small particle areas was obtained through a Tracor Northern TN5500 microanalyser, coupled to the SEM. A horizontal Si(Li) crystal was used as detector, with a 30mm2 surface area, giving a 154 ev resolution. Voltage pulses from the detector are digitized by an analog-to-digital converter (ADC) based on peak heights. A histogram of intensity versus amplitude is formed by storing as sequential ADC channels (up to 4096). Data processing was by DEC LSI 11/23 minicomputer with 256K byte CPU, twin disk drives, high resolution colour monitor and dot matrix printer.

Representative EDX spectra were collected manually in spot mode for 50 seconds at 20 Kev excitation. Final EDX peak spectra were routinely collected over the 0 to 10 Kev range. If heavy elements were indicated, diagnostic peaks beyond 10 Kev were monitored.

3. Automated Particulate Analysis:

Automated SEM-EDX-image analysis was performed on polished pellets of leucite or cold-resin mounts, using backscatter electron imaging and EDX as described. Methods were modified from those of Huggins et al (1982), using software and hardware modules from Tracor Northern Inc (Madison, Wisconsin).

Digital beam control was implemented through hardware modules, TN-1310 and Microscan and run parameters were selected by the operator and stored to disk. The SEM beam was stepped over the field of view in regular spacings. A large grid-point spacing (off-point) was used to locate particles with denser spacings (on-point) used to measure particles. Particle recognition was based on lower and upper thresholds of the digitized video signal (BEI).

Once detected, particles are measured for dimensions and shape, based on eight diagonals traced by the beam. The particle center is used to locate the beam for subsequent Xray acquisition. The dimensional data include average, minimum and maximum diameters, perimeter, area and position. Xray data yield relative proportions of elements and Xray counts, used to classify the particles by chemical type.

For each particle, a "shape factor", based on area and perimeter is calculated, and used to control the recognition of grains:

$$\text{shape factor} = \frac{(\text{perimeter})^2}{\text{area} \times 4\ \text{pi}}$$

example:
= 1.0 for sphere
= 1.27 for square
= 3.85 if aspect ratio is 10:1
= 7.0 if aspect ratio is 20:1

Two software programmes are used, written in Flextran, and designed for simple, non-overlapped, low-aspect ratio particles:

1. Particle Recognition and Characterization (PRC): program for data acquisition.
2. Particulate Reanalysis Program (PRP): for editing and file merging.

Average particle sizes are displayed as histograms for each chemical type (i.e "mineral"). Up to 25 elements are monitored for the definition of up to 61 chemical types. The parameters of operation and the chemical classes were developed at the Atlantic Coal Institute and substantially modified from those of Huggins et al (1982) and Hamburg (1984).

For this project, we selected two magnifications and particle size ranges. At 50x magnification we covered particles of 5 to 75 microns with 1 - 7 shape factors. At 500x we covered the ultrafines of 0.5 to 7.5 microns average diameter. Off-point spacing was defined by the minimum particle size class with on-point spacing at 10%. The lower threshold was set on a BEI signal slightly above coal background, with the upper threshold at maximum. Xray acquisition was from 20 Kev excitation, for 2 seconds per particle with no ZAF corrections.

MINERALOGY AND COAL COMBUSTION: LITERATURE REVIEW

Introduction:

Some 2 billion metric tons of pulverized coal are burned annually in large electrical utility boilers, releasing about 300 million tons of minerals and inorganic elements from their organic maceral matrix. Some of these minerals fuse at combustion temperatures and deposit as slag on the heat transfer surfaces. Concerns for boiler efficiency must therefore address the role of this mineral matter. Raask (1985) has summarized the British experience relating minerals and coal combustion. Kautz (1984), Mraw et al (1983) and Reid (1984) reviewed German and American perspectives. Cope and Dacey (1984) addressed all types of solid residues from coal and provided a glossary:

fly ash	Combustion ash entrained in flue gas.
bottom ash	Ash, remaining at base of combustion chamber.
pulverized fuel ash (PFA)	Fly ash (80%) or bottom ash from pulverized coal combustion
slag	Bottom ash, heated beyond ash melting-temperature.

The factors that influence the nature of these ashes are numerous (Figure 1.), of which the coal mineralogy and particle size are two. Foster Wheeler Energy Corporation (see Statement of Work) reported that ash deposition increased with pulverized coals (<75 microns) but decreased with micronized coals (<10 microns). Our study attempts to explore this phenomenon from the point of view of Canadian coals.

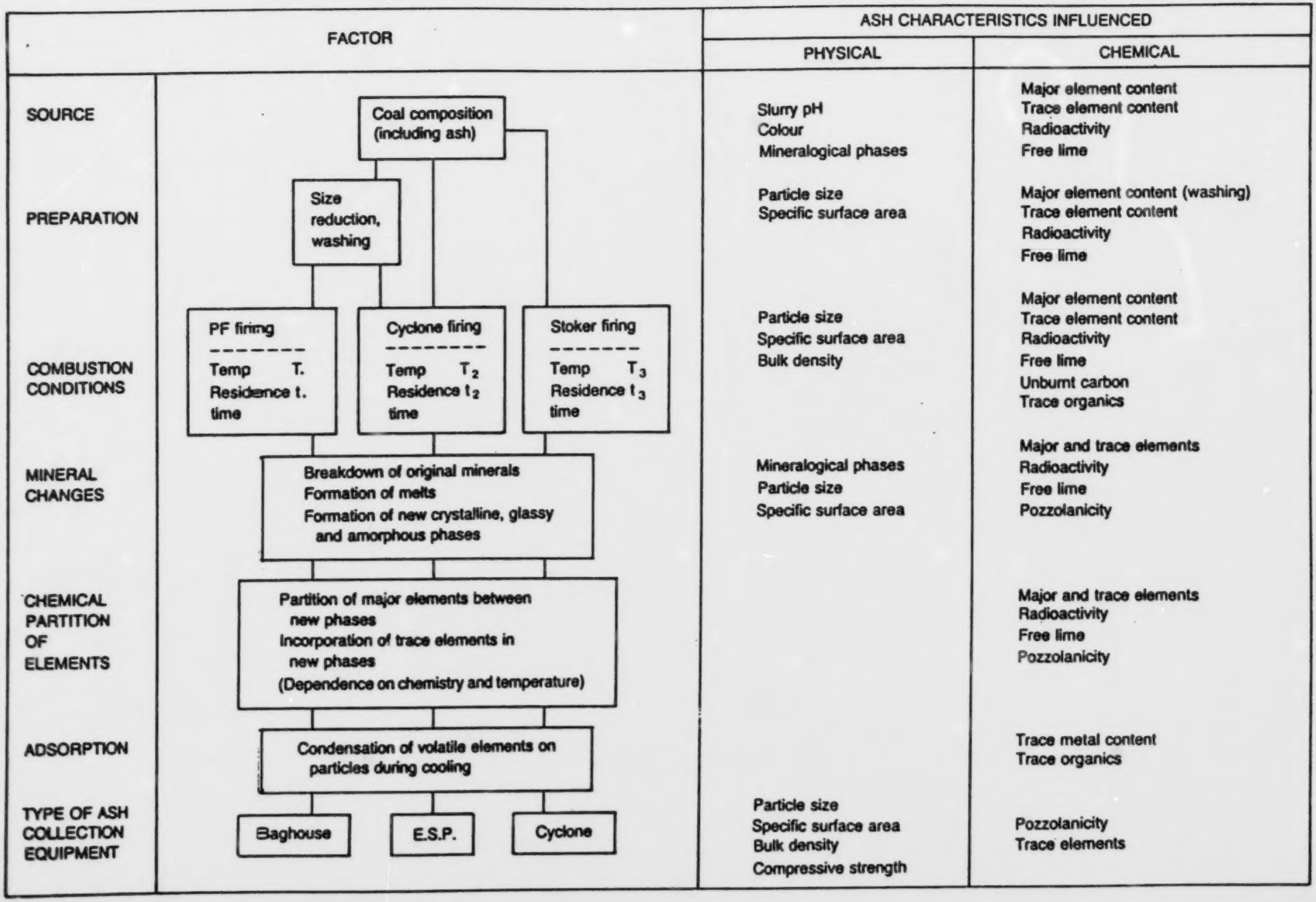
Particulate Combustion:

Pulverized coal-fired boilers usually operate with surplus oxygen, therefore an oxidizing atmosphere for the particles of burning coal. On the otherhand, as Mraw et al. (1983) pointed out, the gas environment for mineral inclusions during particle combustion is less predictable. The organic maceral envelope may persist until late stages and preserve a reducing micro-environment (Figure 3.).

The reducing environment will decrease the fusion temperature of some minerals, thus increasing their slagging potential. Larger coal particles should provide shelter from oxidation for longer. It follows that for combustion of finer coal, the minerals liberated by comminution, experience an oxidizing environment with higher fusion temperatures. These melt temperatures may also be altered by coalescence of different mineral chemistries. Coarse coal would prevent mineral inclusions from making contact, while pulverized coal would show enhanced grain contact. With micronized coal, the ultrafine particles may cool too quickly to allow extensive coalescence.

The size of coal particles will influence heat transfer and therefore the maximum temperatures attained. Raask (1985) states that submicron particles attain the temperature of the flame while larger particles may be 200 degrees cooler. The combustion rate for different macerals may also

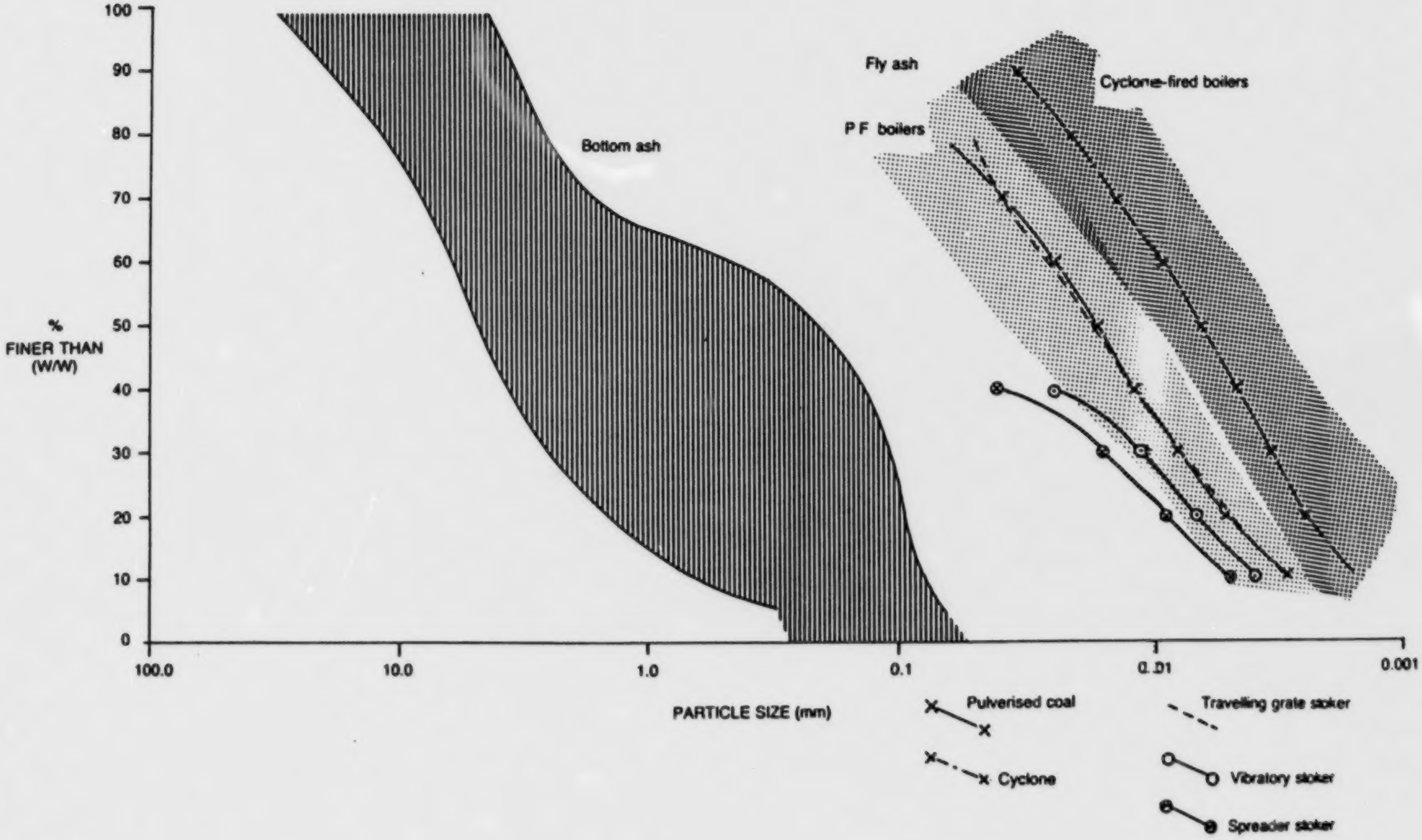
Figure 1. After Cope and Dacey (1984)



FACTOR		ASH CHARACTERISTICS INFLUENCED	
		PHYSICAL	CHEMICAL
SOURCE	Coal composition (including ash)	Slurry pH Colour Mineralogical phases	Major element content Trace element content Radioactivity Free lime
PREPARATION	Size reduction, washing	Particle size Specific surface area	Major element content (washing) Trace element content Radioactivity Free lime
COMBUSTION CONDITIONS	PF firing: Temp T. Residence t. time Cyclone firing: Temp T_2 Residence t_2 time Stoker firing: Temp T_3 Residence t_3 time	Particle size Specific surface area Bulk density	Major element content Trace element content Radioactivity Free lime Unburnt carbon Trace organics
MINERAL CHANGES	Breakdown of original minerals Formation of melts Formation of new crystalline, glassy and amorphous phases	Mineralogical phases Particle size Specific surface area	Major and trace elements Radioactivity Free lime Pozzolanicity
CHEMICAL PARTITION OF ELEMENTS	Partition of major elements between new phases Incorporation of trace elements in new phases (Dependence on chemistry and temperature)		Major and trace elements Radioactivity Free lime Pozzolanicity
ADSORPTION	Condensation of volatile elements on particles during cooling		Trace metal content Trace organics
TYPE OF ASH COLLECTION EQUIPMENT	Baghouse E.S.P. Cyclone	Particle size Specific surface area Bulk density Compressive strength	Pozzolanicity Trace elements

Figure **Factors influencing ash characteristics**

Figure 2. From Cope and Dacey (1984)



Particle size distributions for fly ashes and bottom ashes
(From Bahor *et al*, 1981; Southern Research Institute, 1977)

Table 1.

Mineral distribution in pulverized coal.

MESH SIZE	PARTICLE (microns)	ASH (proportion)	DISTRIBUTION: (preferential)
80-200	200-76	0.5-0.8	adventitious minerals
200-800	76-20	1	quartz carbonates pyrite
800-1600	20-10	1.3	clays, pyrite
-1600	<10	1.5-2.5	clays (0.1-10 um)
ungraded		1	most minerals: 0.1-5 microns

after Raask (1985)

Table 2.

Mineral melt temperatures versus coal combustion conditions.

COMBUSTION TYPE:	TEMP. RANGE: C	COAL FEED SIZE:	ASH PARTICLES:	MINERAL MELTS, DECOMPOSITIONS('C):
Cyclone-fired flame	1725-1887	>500 micron	molten slag, flue gas	Zircon (2550) Rutile (1827) SiO_2, Al_2O_3 fumes Mullite (1810)
Pulverised coal Flame	1475-1725	<100 micron	0.1-5um ash, <4% cenospheres, 0.05-0.25um dust	Quartz (1710) Apatite (1225) Pyrrhotite (1152) Na_2SO_4,K_2SO_4 fumes (>927)
Fluidized Bed	825-925	<2 mm	granular ash, coke,cenospheres	Calcite (925) clays (>825)
ASTM D3174 ASTM D3172 (HTA)	750	-60 mesh	granular ash 1-20% SO_3	Pyrite (600) Dolomite (773) Ankerite (727) Siderite (527) clay dehydrox.(>375) NaCl (227-600)
Low Temp. O_2 Plasma (LTA)	<150	-60 mesh	free minerals, amorphous <20%	clay dehydrate (>27) $CaSO_4.H_2O$ formed

Compiled from Raask (1985), Reid (1984), Mraw et al (1983)

Figure 3.
From Reid (1984)
and Mraw et al (1983)

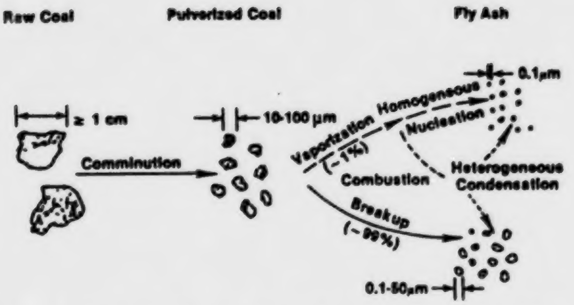

Raw Coal
Pulverized Coal
Fly Ash
≥ 1 cm
10-100 µm
0.1µm
Comminution
Vaporization
(~1%)
Homogeneous
Nucleation
Combustion
Heterogeneous
Condensation
Breakup
(~99%)
0.1-50µm

Fig. 3. Processes which contribute to formation of fly-ash particles (from Flagan and Friedlander, 1978).

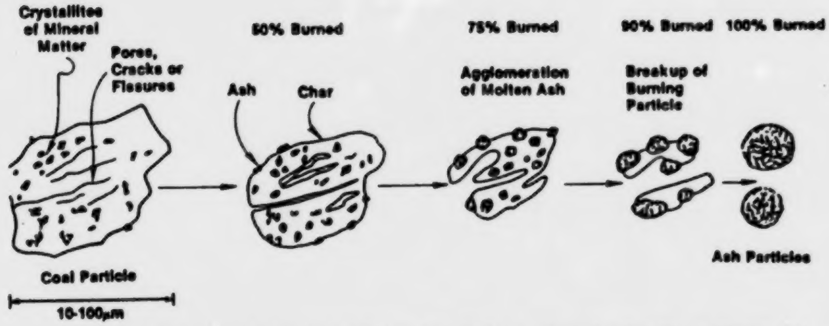

Crystallites
of Mineral
Matter
Pores,
Cracks or
Fissures
Coal Particle
10-100µm
50% Burned
Ash
Char
75% Burned
Agglomeration
of Molten Ash
90% Burned
Breakup of
Burning
Particle
100% Burned
Ash Particles

Fig. 2. Ash agglomeration and particle breakup during coal combustion (from Flagan and Friedlander, 1978).

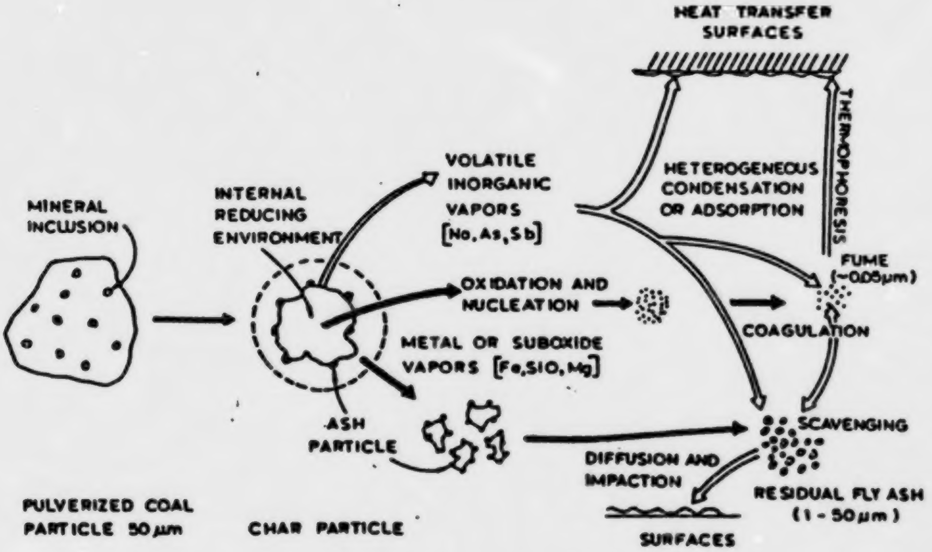
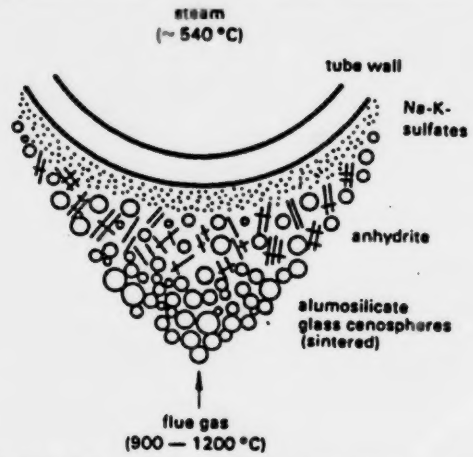

MINERAL
INCLUSION
PULVERIZED COAL
PARTICLE 50µm
INTERNAL
REDUCING
ENVIRONMENT
ASH
PARTICLE
CHAR PARTICLE
VOLATILE
INORGANIC
VAPORS
[Na, As, Sb]
OXIDATION AND
NUCLEATION
METAL OR SUBOXIDE
VAPORS [Fe,SiO,Mg]
HEAT TRANSFER
SURFACES
HETEROGENEOUS
CONDENSATION
OR ADSORPTION
THERMOPHORESIS
FUME
(~0.05µm)
COAGULATION
SCAVENGING
DIFFUSION AND
IMPACTION
SURFACES
RESIDUAL FLY ASH
(1 - 50µm)

Fig. 1. Schematic of ash-particle formation and deposition mechanics.

Figure 4. Slagging and Fouling in coal-fired boilers
From: Kautz (1984)


steam
(~ 540 °C)
tube wall
Na-K-
sulfates
anhydrite
alumosilicate
glass cenospheres
(sintered)
flue gas
(900 — 1200 °C)

Normal build-up of gas-side fouling from flue gas constituents.

Parameters influencing slagging, fouling and corrosion in coal fired boilers.

coal characteristics: macerals + volatiles } intergrowth mineral matter
burner and furnace parameters (heat releases, mainly burner belt heat release)
chemical flue gas conditions: O_2 — CO — Cl — S^{2-}
physical flue gas conditions: velocities, partial pressures
selective disposal + sublimation
chemical reactions on heating surfaces
tube metal temperatures

be a factor. Minerals surrounded by macerals will be subject to the carbonization and combustion temperatures of their host. Micronized coal minerals will be freed of this influence.

The size distribution of minerals in coal and their degree of encapsulation is an important factor in pulverized fuel combustion. The degree of comminution for the coal feed controls the mineral-maceral relationships and also changes the thermal conditions. The micronized coals may represent near-complete dissociation of minerals from macerals resulting in higher fusion temperatures and grains too small to coalesce. The smaller grains furthermore experience higher temperatures.

Particle Size Factors:

Pulverized coal fuel is generally -200 mesh (<75 microns), compared to ASTM laboratory tests which use -60 mesh (<250 microns). Micronized coal, on the otherhand requires ultrafine milling to less than 10 microns, considerably less than the finest standard laboratory sieve size of -400 mesh (<38 microns). McCurdy et al (1985) demonstrated that wet grinding of bituminous coal in a McCrone Micronizing Mill can achieve this within 10 minutes, to a median particle size of 5.7 um with 90% of particles below 14 microns diameter.

Micronized coal displays several unique properties which have potential in beneficiation and combustion. Chemical diffusion is enhanced for microbial enzymes or catalysts in deep-cleaning processes. Minerals are largely liberated from macerals for cleaning by froth flotation. Particles show a narrow, log-normal size distribution and disperse readily in water or oil (Lloyd 1986).

Sarofim et al. (1977) reported that the distribution of mineral matter in pulverized coal is independent of the coal particle size, as long as coal grains are orders of magnitude larger than most inclusions. This conflicts with Raask (1985) who reported a bias of clays in < 20 micron versus < 200 micron coal (Table 1.). This can be explained by considering particle size distributions in a pulverized coal as expressed by the Rosin-Rammler equation:

$$W = 100 \exp (-d/f)^n$$

where:

W is weight % of particles > d diameter
f is measure of fineness
n is measure of spread in sizes

For pulverized coal, the typical values for f and n are 30-70 microns and 1.2 respectively (Raask 1985). The low n value indicates a wide size spectrum.

Minerals will show a distribution in this spectrum, weighted towards smaller sizes because of the dominance of clays (0.1 - 10 micron) and because of the density differences between coal and minerals which influences transport. Pulverized coal samples that have undergone sieve or gravity separation will show this phase bias.

Macerals also exhibit a particle size bias. Because they differ in resistance to fracture, during comminution, the macerals will show an increasing grindability series: durain < clarain < vitrain < fusain (Lytle *et al*. 1983a). Both particle size and shape are influenced during grinding by microstructure, especially the mineral-maceral interfaces, which promote phase separations (Lytle *et al*. (1983b).

Mineral inclusions in coal will show size distributions dictated by their genetic histories. Detrital grains of quartz and clay reflect the grain size distribution during peat deposition. Syngenetic pyrite formed as crystals, framboids or cell casts of uniform (1-100 um) dimensions. Epigenetic minerals such as calcite, filled cleats and pores of less predictable size.

Particle size distributions are also a characteristic for ash from various combustion settings. Cope and Dacey (1984) point out that collection procedures as well as furnace type control particle dimensions. Figure 2. shows that fly ash from cyclone-fired boilers is finer than ash from pulverized coal firing.

Minerals in Coal:

The mineralogy of coals has been extensively investigated by optical microscopy (Sprunk and O'Donnell 1942), and more recently by electron microscopy and other instrumentation techniques. Russell and Rimmer (1979), Finkelman and

Gluskoter (1982) and Mraw et al (1983) review the present methodology.

Coal grains generally consist of bands (>50 microns) of maceral associations called microlithotypes. Of these, "vitrain" contains relatively low amounts of minerals, whereas "fusain" is an ubiquitous host for minerals ranging from <0.1 to 100 microns in diameter. "Carbargillites" are interlaminated macerals and minerals with 20 - 60% by volume of clays and quartz. "Carbopyrite" grains carry 5 - 20% pyrite.

Pulverized coal particles greater than 50 microns in diameter can be expected to carry a complex mineral-maceral assemblage, whereas micronized coal, (less than 10 microns) would likely be monomineralic or mineral-free. Such pure macerals would still yield ash from the organically-bound elements.

Ash Tests:

Chemical phase diagrams which could predict the melting behaviour in a multicomponent system such as a coal-mineral particle, are poorly known (Mraw et al. 1983). Investigations have therefore concentrated on bulk physical measurements to predict ashing behaviour, including ash viscosity, adhesion, agglomeration and fusion temperature. The viscosity of coal-ash slags covers too wide a range for any one test method (Raask 1985). Thermal agglomeration of ash particles (sintering) has been quantified by measuring reheated bulk ash for crushing strength, sieve size, or electrical conductance. Raask (1985) described a vertical furnace for simultaneous measurement of ash conductance and shrinkage.

Conventional ash fusion tests are empirical, based on shape changes for a pellet of ash, heated in a laboratory furnace. National standards (U.S.A, ASTM D1857; British 1970; German DIN 51730; French M3-012) differ considerably in methodology: sample geometry (pyramids, cylinders), heating rates (2.5 to 10°C/minute), atmospheres (air, CO_2, $CO:H_2$, $CO:CO_2$, $CO:H_2O$, $H2:H_2O$) and observations. Correlation of these laboratory results to boiler conditions is not standardized. Futhermore, we know that mineral transformations are very dependent on other factors of combustion such as duration, furnace design, and particle size.

These cited methods which characterize bulk ash or coal do not reveal the behaviour of individual particles during pulverized fuel combustion. Raask (1985) described a method of characterizing sintering for individual particles of boiler slag. Ground slag of 60 micron diameter was placed in a grove on platinum foil and reheated. The neck growth between particles was measured microscopically and related to time and particle size. This method still addresses the bulk material since the slag was formed by ash agglomeration from many coal grains. Each coal grain represents a complex chemical environment with a variable suite of mineral inclusions.

Characterization of Fly Ash:

A review of some 284 publications on coal fly ash up to 1980 was presented by Roy et al. (1981). From this survey, a morphogenesis scheme was proposed which relates the opacity of fly ash particles to composition, and their shape to combustion temperature (Figure 5). Carbonaceous skeletal structures and vesicular spheres form at low combustion temperatures while higher temperatures result in glassy spheres, either solid glass; hollow, filled with CO_2 or N_2 ("cenosphere"); or hollow, packed with spherules ("plerospheres"). Additional particle types, described by Lauf (1982), are listed in Table 4.

The chemistry and mineralogy of fly ash is controlled by the feed coal and combustion conditions. Amorphous glass predominates, with various additions of mullite ($Al_6Si_2O_{13}$), magnetite (Fe_3O_4), hematite (Fe_2O_3) and quartz (SiO_2). Other minerals reported are: calcite ($CaCO_3$), anhydrite ($CaSO_4$), gypsum $CaSO_4.2H_2O$), goethite ($HFeO_2$), periclase (MgO), borax ($Na_2B_4O_7.10H_2O$) and residual silicates: chlorite and illite. Elemental partitioning is observed between particle sizes,

Figure 5. From: Roy et al (1981)

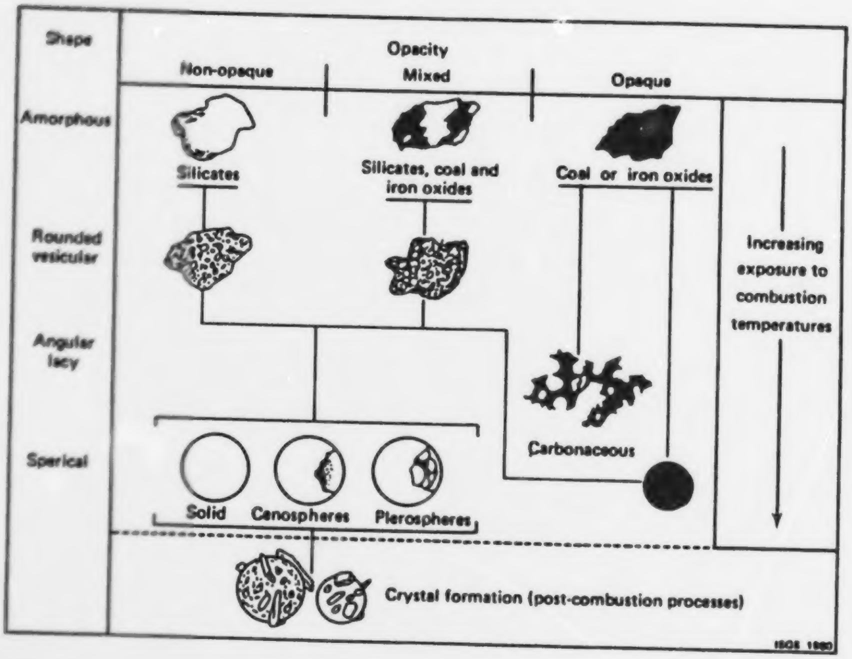

Shape
Opacity
Non-opaque
Mixed
Opaque
Amorphous
Silicates
Silicates, coal and iron oxides
Coal or iron oxides
Rounded vesicular
Angular lacy
Sperical
Solid
Cenospheres
Plerospheres
Carbonaceous
Increasing exposure to combustion temperatures
Crystal formation (post-combustion processes)
ISGS 1980

FIGURE Fly ash morphogenesis scheme illustrating probable relationship of opacity to particle combustion and relationship of particle shape to exposure to combustion temperatures (modified from Fisher et al., 1978).

Figure 6a.
From Roy et al(1981)

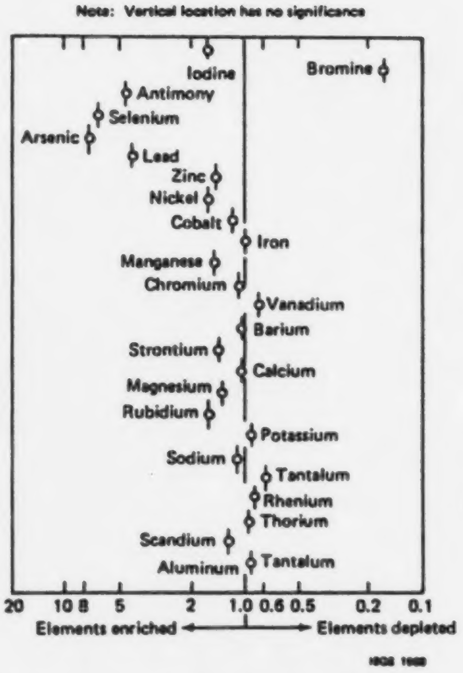


FIGURE Enrichment factors of various elements in fly ash as related to concentrations in coal (from Torrey [ed.], 1978).

Figure 6b.
From Roy et al (1981)

TABLE Estimated polycyclic aromatic hydrocarbon (PAH) concentrations in coal ash (from EPRI, 1978).

PAH	Concentration (μg/kg)
1,2-Benzofluorene	36.8
Phenanthrene	17.6
9,10-Dihydroanthracene	12.6
2,3-Benzofluorene	11.8
Biphenyl	10.3
2-Methylanthracene	9.1
Napthalene	8.3
1-Methylnaphthalene	5.2
2-Methylnaphthalene	5.0
1,6- and/or 1,3-Dimethylnaphthalene	<0.2
2,6-Dimethylnaphthalene	<0.2
1,5- and/or 2,3-Dimethylnaphthalene	<0.2
1-Methylpyrene	<0.2
Picene	<0.2
1-Methylphenanthrene	<24.8
Pyrene	<19.0
Fluoranthene	<13.4

caused by vaporization of volatile elements and subsequent condensation onto entrained particles. Thus, many elements are enriched in fly ash, at increasing concentrations with decreasing particle size (Figure 6a.).

American investigators have reported differences in mineralogy and chemistry of fly ashes derived from Western bituminous versus Eastern bituminous coals. Fly ash from Eastern coals contain higher percentages of amorphous material. Midwestern coals yield ashes higher in trace elements and have revealed traces of gypsum. Eastern ashes show higher Zn, As, Cd, Co, Cr, Pb and Sb (Roy et al. 1981).

The major element chemistry of fly ashes has been used by Roy and Griffin (1982) to construct a classification scheme (Figure 7a.). supplemented by pH, trace element and textural data. Eastern U.S. ash fall in the Modic and Fersic fields, while Western sub-bituminous ash plot in the Modic, Calsialic and Calcic fields. Red or brown ashes generally plot as Fersics, Ferrics or Modics. Gray ashes are Modic or Sialic while white or cream colours correlate to Calsialics or Calcics.

McCrone W.C. and Delly J.G. (1973) compiled the particle morphology of various coal ashes viewed by scanning-electron microscopy (SEM) and analysed for major elements by energy-dispersive Xray (EDX). Their observations for different ash sources are listed in Table 3. These

FIGURES 7. a, b, c, d.   From: Roy and Griffin (1982)

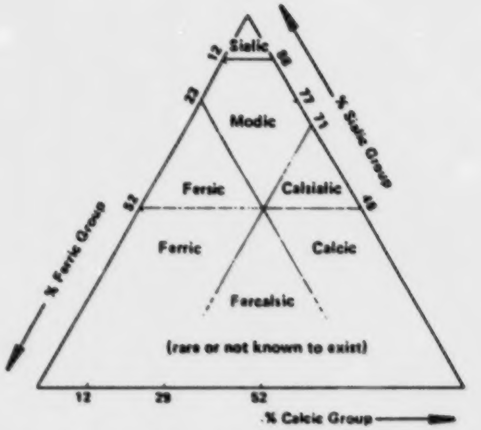

Sialic
Modic
Fersic
Calsialic
Ferric
Calcic
Fercalsic
(rare or not known to exist)
% Sialic Group
% Ferric Group
% Calcic Group
12
23
52
88
77
71
48
12
29
52

Fig. 1—Triangular graph for coal fly ash classification.

Summary of nomenclature and examples.

Group	pH character (prefix to group name)	Special compositional properties and texture (examples)
Sialic	acid	Acid C-Sialic silt
	neutral	Neutral Ba, C-Sialic
	alkaline	Alkaline B, Ba, C-Sialic
Modic	acid	Acid Ba, Zn-Modic loam
	neutral	Neutral B, Zn-Modic
	alkaline	Alkaline C-Modic
Fersic	acid	Acid B-Fersic silt loam
	neutral	
	alkaline	
Calsialic	acid	
	neutral	
	alkaline	Alkaline Zn-Calsialic
Ferric	acid	Acid Cd-Ferric silt loam
	neutral	
	alkaline	
Calcic	acid	Acid Ba, Cu, Zn-Calcic silt
	neutral	
	alkaline	
Fercalsic	acid	
	neutral	Neutral C, Ba, Cu-Fercalsic
	alkaline	

Table 2—Ranges and average chemical compositions of fly ashes used in the classification system.†

Constituent	Range	No. of data	Avg.	± SD
	%		— % —	
SiO_2	2.19–68.1	58	44	13
TiO_2	0.5–2.55	39	1.3	0.5
Al_2O_3	3.39–39.4	60	23	6.5
Fe_2O_3	3.60–29.2	58	11	6.5
CaO	0.2–31.0	58	8.2	8.0
MgO	0.4–12.8	58	2.7	2.7
Na_2O	0.2–8.0	50	1.8	2.0
K_2O	0.2–8.1	49	2.0	1.8
C	0.1–25.7	21	5.0	8.1
SO_3	0.1–7.28	47	1.6	1.9

† Data from the literature and unpublished data from Illinois State Geological Survey files.

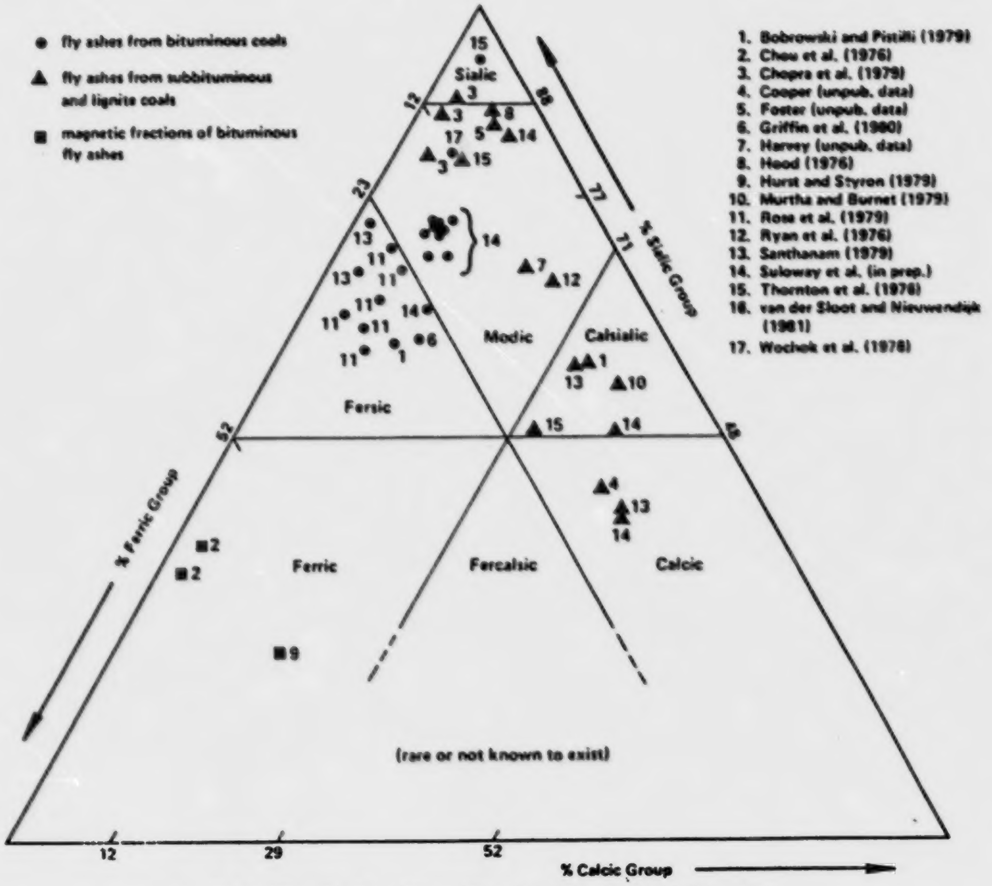


Fig. 2—Classification of 39 coal fly ashes using the triangular graph.

Table 3. SEM-EDX observations on coal fly-ash.
(compiled from McCrone and Delly, 1973: pp775-779, 753)

SOURCE	MORPHOLOGY	EDX SPECTRA
domestic furnace (fuel bed)	trace sintering, no carbonaceous matter	Si>Ca>Al>Fe>Ti>S
underfeed stoker (hot burn)	sintering, tiny glass beads	Si>Al>Fe>S>K>Ba
underfeed stoker (poor burn)	vugs, tiny glass beads	Al>S>Si>Ca>Fe high Bremsstrahlung
chain grate (near-complete combustion)	glassy spheres magnetite spheres	Fe>Si>Al>Ca>K>S Bremsstrahlung
chain grate (partial burn)	magnetite spheres	Fe>Al>Si>K>Ca>S>Ti
spreader stoker (partial burn)	network of coke, unburned coal	Al>Si>S>K>Ca>Fe>Ti
pulverized-coal electrostatic precipitator (100% burned)	glass spheres (<3 um) Fe3O4 spheres with CaSO4 coat (0.2-0.3 um)	Si>Fe>Al>Ca>K>S>Ti
pulverized-coal stack breech	glass spheres	Fe>Si>Ca>Al>K
pulverized-coal stack breech	glass & magnetite spheres, cenospheres tarry coal exudate	Si>Al>Fe>Ca>K>S>Ti
pulverized-coal (low temperature)	glassy spheres of wide sizes (<1 to 50 um) plerospheres, magnetite spheres	Si>Al>Ca>Fe>K>S
pulverized-coal (incomplete burn)	magnetite spheres, unsintered ash, unburned coal, coke partial-sintered ash	Si>Ca>Al>Fe>S>K>Cl>Ti

Table 4. Fly-ash particle terminology (from Lauf 1982).

TERM:	DESCRIPTION:	SIZE:
Glass Spheres	solid, part devitrified, contain gas bubbles	2-80 microns
Coke	irregular, part anisotropic white reflectance carry residual minerals	> 300 microns
Cenospheres	hollow spheres	
Plerospheres	hollow spheres, filled by smaller spheres.	
Ferrospheres	Magnetite spheres optically isotropic pseudomorph (pyrite framboids). light (spinel), dark (mullite) phases	<22 microns
Dermaspheres	layered spheres, radial glassy layer on crystal core	>0.5 microns
Irregular Silicates	agglomerations low reflectivity contain small cenospheres, plerospheres.	

observations did not consider the coal type or mineralogy and therefore give only limited conclusions. Incomplete burn in fuel-bed furnaces appeared to give high Fe or Al ash whereas all pulverized-coal combustion lead to high Si ash. The presence of unburned coal, coke and chlorine indicates incomplete combustion whereas high temperature combustion of pulverized coal gave glass and magnetite spheres. Lower temperature burns gave large cenospheres and plerospheres.

Mattigod (1982) characterized sub-bituminous coal fly ash particles according to size (45-20-15-8-2.7-0 microns) and density fractions (>3.3-2.9-2.6-2.1,<2.1 g/cm^3). The lightest particles in all size classes are cenospheres and plerospheres consisting of mullite crystals in glass. Heavy particles (>3.3 g/cm^3) are magnetite with minor hematite and calcium ferrite. Intermediate gravities show quartz and anhydrite chemistry. Refractory trace minerals (zircon, rutile, barite) show up in non-magnetic portions of the >3.3 gravity split.

These studies of coal ash relate to specific coals under certain combustion conditions. Laboratory simulations of coal combustion can only approximate these conditions. Studies of mineral matter transformation based on heating samples in crucibles do not creat the microenvironments of free-falling particles. Therefore, neither the morphologies nor the particle chemistries reported by these workers can be anticipated for combustion simulations. Furthermore, studies on ash cannot be interpreted without considering the parent coal.

Mineral Transformations:

Hubbard et al. (1984) studied pulverized coal ash by XRD, SEM, TEM and XRF in order to relate particulates to mineral transformations. From particulate compositions and textures they proposed parentages. Pulverized-fuel combustion was modeled as flash-ignition at 1500°C causing thermal metamorphism and anatexis. Quartz and hematite survive this thermal shock. Pyrite oxidizes to magnetite with the release of SO_2. The clays lose structural water at 200°C, then recrystallize to mullite and cristobalite before melting at 1100 - 1600°C. Because of the rapid heating, the bound water and potassium in illite will flux partial melting to produce gas-filled bubbles which cool quickly into cenospheres. Kaolinite, in the absence of potassium does not reach melting point but dehydrates into sphere-free amorphous aggregates and crystals of mullite.

The chemical phases in the resultant fly ash reflect these reactions. Quartz is present as detrital grains or as a cryptocrystalline phase in glass. Mullite is limited to clay residues or cenospheres. Magnetite coats spheres or forms pseudomorphs after pyrite framboids. The actual mineral suite in ash is dependent, however on the parent coal mineralogy. Each mineral suite, specific to the coal and seam position, will represent a different chemical environment and subsequent fluxing behaviour.

Hubbard et al. (1984) assumed a PF combustion temperature of 1500°C while Raask (1985) reported a range (1475-1725°C). The individual mineral melting temperatures, prior to interactions, is given in Table 2. These thermal conditions, as well as other combustion factors will dictate the nature of mineral transformations. As an example, Saporoschenko et al. (1980) monitored changes in iron-bearing minerals in pulverized fuel combustion, pyrolysis and liquefaction. From an initial pyrite-illite coal mineral suite, pyrolysis to char yielded pyrrhotite and spinel, while power plant fly ash contained mullite, hematite, goethite, magnetite and Fe silicates.

Pulverized Coal: Simulated Combustion:

Sarofim et al. (1977) studied particle behaviour during laboratory simulation of pulverized coal combustion by monitoring initial minerals and ash. Bituminous coal at two size grades (38-45, 75-90 microns) was injected at 0.1 gm per minute via an air stream into a drop-tube furnace for rapid combustion at 757 and 1557°C. Particles experienced a 1 sec. isothermal combustion over 15 cm of furnace and fell to a water-cooled collection base. Particles were evaluated for morphology and chemistry by SEM-EDX; for particle-size by a particle counter; and for density by heavy-liquid separation.

These authors model the combustion of a coal particle as a shrinking sphere, burning at its surface. As minerals are exposed, they fuse and agglomerate. Char particles fragment during late combustion, forming about 5 ash particles for each original bituminous coal grain. The size distribution of ash is proportional to the parent coal particles. As combustion temperature increases, a larger proportion of ash is formed by condensation of submicron particles such as silica. Gas evolution during heating of minerals creats spheres which contribute to larger particle sizes but low densities. Their formation is optimized at about 1000°C, with particles showing a four-fold expansion.

The same furnace assembly was used by Mims et al. (1980) for a similar study, concentrating on the submicron aerosol. Their combustion model was based on particles burning as shrinking spheres, by char oxidation with carbon monoxide release. They propose that the composition of the vapor, generated during combustion can be predicted for each temperature-time condition, using kinetic data for the minerals. These vapors contribute the sub-micron portion of particulates in fly ash emitted from utility boilers.

The shrinking sphere model implies that the burning coal matrix is isotropic, whereas in fact the constituent macerals show markedly different thermal responses. This was illustrated by Shibaoka (1969) who studied maceral combustion for bituminous coal. Individual grains of macerals were observed, using a hot-stage microscope and a film camera. A thin section of coal (0.02 mm) was burned under an air:nitrogen mixture at a rapid heating rate (1000°C/sec) while filming at 64 frames/second.

On heating the stage, vitrinite and exinite became opaque and developed vesicles for a 0.7 second carbonization event. Inertinite became friable and fragmented. Combustion occurred over the next 0.4 to 1.5 seconds in the rate order: exinite, vitrinite, inertinite. Vitrinite coke showed fringes of partially melted ash while fusinite coke displayed a coating of spheres.

Shibaoka's (1969) results do not apply to all coals. Nandi and Montgomery (1975) used a similar hot-stage approach for observing the macerals of Western Canadian Cretaceous coals, including the Balmer Seam. In these coals, a high inertinite content can be further divided into high and low reflectance semi-fusinite. The low reflectance phase melts at 335°C, while the vitrinite melting point is at 420°C. The high-reflectance semifusinite did not melt at 450°C. The combustion characteristics for each coal are therefore unique. A controlling factor in maceral combustion is devolatilization and vesicle formation at the carbonization stage.

The shrinking sphere model for coal particle combustion is also questioned by the work of Bennett and Luther (1983) from calculations of heat transfer. They concluded that the temperature field in a coal particle is sensitive to particle shape, size and uniformity. Particle combustion cannot be modeled as isothermal since heat gradients are large enough to affect devolatilization rates and products. They therefore caution that heating experiments using milligrams of coal powder cannot expect repeatable chemical results unless heat transfer is controlled.

Rock-Eval Pyrolysis

Rock-Eval is a "brand-name" technique for whole-rock pyrolysis developed at the Institute Francais du Petrole (Paris) and Labifina (Brussels) based on programmed heating to gasify liquid hydrocarbons, followed by thermal cracking of solid organic matter (kerogen). The technique has been applied extensively to shale cuttings from offshore petroleum drilling as well as oil shales but has received only limited attention for coal.

Espitalie et al. (1977), Orr (1981) and Peters (1986) have fully reviewed the Rock-Eval technique. Of interest to our study has been the influence of minerals on such pyrolysis results, as reported by Horsfield and Douglas (1980), Espitalie et al. (1980) and Katz (1983).

Furthermore, the application of this technique to the assessment of combustion characteristics of coal is of interest because of the rapid nature of the analysis and the small sample size.

The Rock-Eval method generates the following analytical information:

1.	S_1 peak	solvent-extractable hydrocarbons (approximately C5-C32)
2.	S_2 peak	products of thermal cracking of kerogen, resins, asphaltenes
3.	T_{max}	temperature at peak pyrolysate yield of S_2

Delsi Inc. (Houston, Texas) has recently introduced a modified version of the Rock-Eval instrument termed an "Oil Show Analyser". With a second oven assembly, the residual carbon after pyrolysis is oxidized to generate an S_4 peak, allowing calculation of the Total Organic Carbon. Earlier versions measured CO_2 emission for an S_3 peak used to assess kerogen type, but this has been discredited due to instrument problems and mineral matrix effects (Katz 1983, Peters 1986).

For the pyrolysis of coal-mineral mixtures, Horsfield and Douglas (1980) demonstrated that pyrolysates change when minerals are present. Likewise, Espitalie et al. (1980) showed that heavy hydrocarbons are retained by the clay when lignite is pyrolysed in the presence of illite.

Coal pyrolysates also change with maceral type. Exinite yields more high molecular weight products (S_2) than vitrinite. Large variations in yield occur within maceral types. A study on resinite-rich coals by Mukhopadhyay and

Gormly (1984) showed differences in Rock-Eval yields for yellow-fluorescent (low T_{max}, high S_2) versus brown fluorescent (higher T_{max}, low S_2) varieties of resinite.

Peters (1986) cautioned that Rock-Eval results on coals may be complicated. The pyrolysis of whole coal does not respond in the same fashion as dispersed organic matter of similar maceral composition (Type III kerogen). Bimodal S_2 peaks indicate a large content of heavy liquid hydrocarbons and will distort the T_{max}. Although the S_1 + S_2 peaks correlate with Fisher Assay for oil shales, in coals there is a general "overestimation" of the liquid hydrocarbon generation. Correlation of Hydrogen Index (S_2/T.O.C>) with atomic H/C is generally poor. For example, in samples of high rank (vitrinite R_o > 1.0%) the oxidation for T.O.C. determination may be incomplete and give low values.

Automated Coal Particle Analysis:

Moza *et al.* (1979) used a computer-controlled SEM-EDX technique to characterize the inorganic chemistry of many coal particles. Melting and adhesion behaviour of slag droplets formed from the mineral inclusions were predicted for each particle based on major element chemistry for five elements (Al, Si, S, Ca, Fe). Coal particle sizes of 8 to 75 microns could be accomodated which corresponds to 90% of the material involved in pulverized-fuel combustion. Subsequent work by Moza and Austin (1983) used a size-range of 10 - 100 microns. These authors classified coal particles into five chemical types with different slagging behaviour during combustion:

TYPE	CHEMISTRY	SLAGGING CHARACTER
I	<0.5 wt% minerals	low
II	high FeS_2	sticky" if FeS_2 > 25 wt%
III	high Fe_2O_3	sticky" if Fe_2O_3 > 50 wt%
IV	CaO < 50 wt% Al_2O_3 < 70 wt%	high slagging low melting
V	CaO > 50 wt% Al_2O_3 > 70 wt%	high melting low slagging

Their technique allowed for a particle-by-particle assessment of the slagging potential for a specific coal, based on the chemical generalizations used for bulk ash. This did not consider the mineralogy of inclusions, nor their micro-environments. The use of ZAF corrected EDX restricted the size range and therefore precluded its application to micronized coal (<10 microns).

Huggins _et al_ (1982) used automated image analysis (AIA) and SEM-EDX to size and characterize the mineral inclusions, rather than the coal grains. Eighteen minerals and seven mixed categories were chemically identified and sized by mean diameter and area from polished grain mounts. By using a spectral "fingerprint" to class minerals, rather than quantitative Xray, their method covered particle sizes from 0.2 to 150 microns. This approach is applicable to both micronized and pulverized coal.

For examining the mineral matter in cokes, chars and ash, this SEM-EDX-AIA procedure has several advantages over alternative mineralogical methods, such as XRD or IR:

1. The SEM-EDX classification is based on mineral composition, rather than crystallography. Therefore the transformations of minerals to amorphous products can be traced. Clay dehydration or partial melting does not mask parentage.

2. The number of mineral species that can be recognized in a mixture is much greater than for XRD or IR. Trace minerals with heavy metals are especially easy to monitor.

3. No mineral standards are necessary to quantify results. This is important for coal minerals such as illite which display variable chemistry.

In a study of coals and matching cokes, Huggins _et al_ (1982) reported that the weight percentage of minerals identified by SEM-EDX-AIA changed little. They concluded that the minerals undergo only decomposition (loss of H_2O, H_2S and CO_2) with no significant reactions, even after hours of burn at temperatures of >1000°C.

Previous Work: Western and Eastern Canadian Coals:

Numerous combustion tests have been performed on the two coals of this study, in publications and internal reports of CANMET (Ottawa), National Research Council, Alberta Research Council, Nova Scotia Research Foundation and various universities across Canada. Nandi and Montgomery (1975) mention the Balmer Seam and cite an unpublished report FRC-71/9 for Sparwood coals. King and Whitehead (1954) and Arseneau and Wiltshire (1980) published on the pyrolysis of coals from the Sydney Basin. Most of these studies, did not consider the role of minerals and particle size.

Whiteway et al. (1985) commented on particle size as a factor in pyrite decomposition. During pyrolysis of Harbour coal (Sydney Basin) H_2S emission peaked at 475°C. This was attributed to decomposition of pyrite inclusions <100 microns in size. If coarser pyrite (200 microns) was added, these decomposed to pyrrhotite at higher temperatures (560°C).

Pyrite decomposition rate may be a function of gas diffusion into the maceral matrix. Cleyle et al (1984) pyrolysed Hub Seam coal (Prince Mine) and found evidence that the pyritic sulphur enters the adjacent matrix. A 20 um pyrite grain, viewed by microprobe, showed partial decomposition at 550°C. The coal matrix showed increases in S adjacent to pyrrhotite, suggesting diffusion from decomposition. They suggested that more massive pyrite, less encapsulated by macerals, may be responsible for the H_2S release seen in bulk coal burns.

This relationship to pyrite morphology was also invoked by Whiteway et al (1985) who suggested that crystallinity plays a role. Prince coal carries "less mature" pyrite crystals than other Eastern coals, including 10% as marcasite. Stirling (1984) reported fine-grained radiating intergrowths of pyrite-marcasite suggesting primary textures.

Roy et al. (1985) mentioned the influence of particle size on vacuum pyrolysis products from Hub Seam coal (Prince Mine) of the Sydney Coalfield. Larger coal particles (8-11mm) yielded higher tar, less char and gas than <1 mm particles. This may have been a mineralogical or maceral influence because the concentration of pyrite and vitrinite was higher in fines.

Ng et al. (1984) conducted porosimetric studies of eleven Canadian coals, including Balmer and Prince seams. Micropore volumes (<.0036 um) decrease linearly with increased coal rank and carbon content. In turn, the pore volume and surface area relate proportionally to coal reactivity in gasification tests. A comparison of pore volume data for Balmer and Prince coals are given in Table 5.

Table 5. Porosimetric data for Western and Eastern Canadian coals (after Ng, Fung and Kim 1984).

PARAMETER:	UNITS	BALMER	HARBOUR	PRINCE
C (daf)	wt %	89.5	87.1	78.1
Helium Density	gm/l	1.407	1.285	1.424
Mercury Density	gm/l	1.151	1.252	1.305
Open Porosity	vol %	18.2	2.5	8.3
Total Pore Volume	ml/gm	0.158	0.02	0.064
Macropores (2.98-.06um) and Mesopores (0.06-.0036um)	ml/gm	0.094	0.021	0.018
Micropores (2.98-0.06 um)	ml/gm	0.065	0	0.046
N2 Surface Area	m2/gm	1.11	0.43	0.86

INTERPRETATION OF RESULTS

Introduction

Petrographic, chemical and photomicrographic data on the two coals is compiled in the Appendix. The following discussion is based on interpretation using certain assumptions inherent to the techniques and samples as outlined here. The original collection of coal and comminution was not conducted by the authors, therefore sample identification and alterations, such as aging or subdivision are assumed from available information.

Analyses from polished pellet mounts of coal represent a few grains transected by the pellet surface. In a heterogeneous material such as coal, these limited samplings may not be representative and may not correlate to bulk analytical results. Particle size estimates from such a two dimensional sampling, are further influenced by the random nature with which the pellet surface transects the grain. Furthermore, the differences in grindability of the minerals and macerals will lead to plucking" during the pellet-making process, with loss of material.

The identification of micron-size inclusions of minerals has relied on energy-dispersive Xray. This technique characterizes the particle chemistry but not crystallinity.

Elements from Na to U on the periodic table, are monitored, but light elements (H, Li, Be, B, C, N, O, F) are overlooked. The minerals are identified on the basis of the EDX spectra reported by Welton (1984), Huggins et al (1980, 1982) and mineral standards run in our laboratory.

Spectral isomers were selected on the basis of the more common occurrences (Sprunk and O'Donnell 1942). Therefore, kaolinite and illite were selected, rather than their isomers: halloysite and muscovite. Pyrite was reported rather than marcasite. Siderite was prefered rather than the oxides magnetite and hematite, unless combustion textures were evident. These assumptions require confirmation by XRD or other technique but such is rarely possible for micro-inclusions.

Particle size histograms for individual minerals (Appendix) must be interpreted with caution. For each magnification, the size of particle will control its backscatter signal and therefore recognition. As the signal falls off, it may lie below the set BEI threshold, and will not be counted. This phenomenon occurs also in light microscopy and influences "point counting" for modal analysis. Furthermore, the size of image field will influence the sampling statistics for larger particles. Such results are therefore largely of comparative value and semi-quantitative at best.

Bulk Characteristics: Eastern Canadian Bituminous

Petrographic analysis on -20 mesh sample P473, revealed a high volatile Bituminous coal with 0.79% reflectance. This "bright" coal has abundant reactive components (91.8%) but only 8.2 % inerts (Table 3, Appendix I). Optically visible mineral matter is minimal, limited to traces of detrital quartz and clays and minor amounts of pyrite. Pyrite is present as "immature", poorly formed crystals, semi-closed to closed framboids, globules and cauliflower forms. Many coal grains are devoid of visible pyrite, indicating that this sample is not typical of high-sulphur Eastern Canadian coal. Therefore it is likely a "metallurgical" grade rather than a "thermal-grade" product, after washing at the Victoria Junction Coal Preparation Plant (Sydney, Nova Scotia).

Table 6. compiles the bulk analytical results on P743 and lists comparable data for other Eastern Canadian coals. Our sample is most similar in ash and sulphur content, to the washed Harbour Seam coal from Lingan and #26 Colliery. Washed Prince coal from the Hub Seam is often substantially "dirtier" in mineralization.

These Eastern Bituminous coals are noted for yielding ash (HTA) high in iron and sulphur oxides. Compared to Western Canadian Bituminous coals (Table 7.), these ashes are lower in titanium but higher in potassium. Since calcium and sodium oxides are low, the iron oxide will control the

Table 6.A. Typical Eastern Canadian bituminous coals, compared to P743.

COAL:	Prince (washed) P743	Prince (washed) (9-12-82)	Prince mine run (3-12-82)	26 Harbour mine run (14-12-82)	Lingan mine run (5-4-84)	Met-coal Lingan+26 (washed)
PROXIMATE %						
ash	1.94	16.28	29.27	7.19	29.03	2.10
volatiles	39.77	33.71	28.04	33.18	36.72	36.73
fixed C	58.25	50.01	42.69	59.63	51.81	61.17
MACERALS %						
vitrinite	78.0					
exinite	13.7					
semifusinite	0.0					
(reactive)	1.0					
(inert)	2.0					
inertinite	5.3					
Reflectance	0.79					
ULTIMATES %						
C	80.17	67.18	56.16	80.35	62.40	84.33
H	5.41	4.35	3.66	4.83	4.05	5.27
N	1.74	1.41	1.2	1.78	1.20	2.09
O (calculated)	8.97	6.12	(5.39)	(4.55)	6.26	(5.14)
S	1.73	4.66	4.32	1.30	1.52	1.07
pyritic		3.51	3.32	0.68	1.03	0.32
sulphate		0.04	0.19	0.00	0.00	0.00
organic		1.11	0.81	0.62	0.47	0.75
BTU	7966	12226	9987	14297	10766	15235
Hardgrove		58	60	72	54	63
FSI		5	4	7	7	8
Ash Fusibility (reducing)						
initial T		1110	1160	1085	1271	1093
spherical		1213	1316	1104	1404	1199
hemispherical		1307	1346	1163	1449	1310
fluid		1341	1382	1266	1510	1393
ASH MAJORS %						
SiO2		39.53	49.62	33.12	54.54	29.15
Al2O3		21.16	23.14	15.87	26.27	19.09
Fe2O3		30.76	16.65	36.47	11.16	42.97
TiO2		0.82	0.87	0.78	0.91	0.94
P2O5		0.18	0.66	0.51	0.17	0.25
CaO		1.32	2.22	3.25	0.50	1.64
MgO		0.78	0.84	1.86	1.58	0.94
SO3		1.41	2.43	4.04	0.32	1.22
Na2O		0.58	0.49	0.75	0.65	0.89
K2O		2.2	1.89	1.54	4.00	0.85
SrO		0.04	0.12	0.01	0.00	0.00
LOF		0	0	0.47	0.10	0.44
Data Source:	this, 3	1	1	1	2	1

Compiled from: 1. Bonnell et al (1983) 2. Birk and Pilgrim (1985)
3. CANMET, personal communication.

Table 6b. Typical Western Canadian bituminous coals, compared to P587.

COAL:	Balmer Seam P587	Harmer Mine Balmer Seam mine run (21-9-1982)	#10 Seam Sparwood	Vicary Creek	Western Canadian bituminous
PROXIMATES %					
ash	9.71	14.47	16.8	10.1	18.2
volatiles	20.96	18.46	17.9	21.75	
fixed C	68.97	67.07	65.3	68.15	
MACERALS %					
vitrinite	61.0		55.2	47.2	40.6
exinite	0.7		0	0	0
semifusinite	34.3			46.6	17.8
(reactive)	11.4				
(inert)	22.9				
inertinite	4.1		44.8	5	41.6
Reflectance	1.43		1.45	1.34	1.12
ULTIMATES %					
C	79.34	76.26	88.6		70.4
H	4.34	4	4.78		4
N	1.33	1.54	1.82		1.1
O (calculated)	(4.7)	(3.46)	(5.02)		(6.0)
S	0.22	0.27	0.23		0.3
BTU	7744	13188			
Hardgrove		102			
FSI				7	
Ash Fusibility (reducing)					
initial T		1471			
spherical		1482+			
hemispherical		1482+			
fluid		1482+			
ASH MAJORS %					
SiO2		60.55	63.77		
Al2O3		27.79	27.06		
Fe2O3		2.45	2.64		
TiO2		1.44	1.39		
P2O5		1.16	0.52		
CaO		2.46	2.31		
MgO		0.19	0.7		
SO3		0.92	1.4		
Na2O		0.1	0.04		
K2O		0.82	0.32		
SrO		0.03	-		
LOF		0.17	0.3		
Data Source:	this, 2	1	5	3	4

Compiled from: 1. Bonnell et al (1983) 2. CANMET, personal communication.
3. Nandi and Montgomery (1975) 4. Nandi et al (1976)
5. Goodarzi et al (1985).

Table 7.

Rock-Eval Pyrolysis and Elemental Analysis :

EASTERN BITUMINOUS: Prince Mine, Hub Seam (Washed) P743

Parameter:		-20 mesh whole coal	-200 mesh sieved	-400 mesh sieved	
	C	80.17	76.93	76.27	%
	H	5.41	5.06	4.94	
	N	1.74	1.28	1.31	
	O	(8.97)	9.24	8.85	
	S	1.73	*	*	
Rock-Eval	S1	1.94	6.45	10.32	mg/g
	S2	173.50	175.65	180.25	
	Tmax	425	428	428	deg C
	T.O.C.	79.24	68.42	67.86	%
Hydrogen Index		218	256	265	

WESTERN BITUMINOUS: Balmer Seam, (Washed) P587

Parameter:		-20 mesh whole coal	-200 mesh sieved	-400 mesh sieved	
	C	79.34	79.02	78.82	%
	H	4.34	3.97	4.02	
	N	1.33	1.04	0.96	
	O	(4.7)	4.62	4.60	
	S	0.08	*	*	
Rock-Eval	S1	2.24	4.19	5.35	mg/g
	S2	97.05	101.23	102.64	
	Tmax	471	472	471	deg C
	T.O.C.	49.92	67.72	74.49	%
Hydrogen Index		194	149	137	

Notes: ( ) = calculated, not determined * = insufficient sample slagging behaviour of this coal ash. Based on Raask's (1985) table 15.13, these ash compositions for washed Eastern Canadian coals show very high slagging propensity, although the amount of ash is low.

Bulk Characteristics: Western Canadian Bituminous

The Western Canadian sample (P-587) is a medium volatile bituminous coal, with a mean maximum reflectance of 1.43%. The maceral composition is markedly different from the Eastern sample, with a lower reactive component (68.5%) and higher inert component (31.5%). If this sample behaves similar to the Vicary Creek coal during combustion, (Nandi and Montgomery 1975), then the reactive semifusinite will contribute significantly to thermal degradation.

Clays were commonly observed in reflected light, together with occassional detrital quartz, in the plane of bedding. Pyrite in contrast was very rare, occurring only as pinpoint crystals dispersed in macerals. The ash content is high relative to the Eastern coal but low compared to other Western analyses. This confirms the "washed" nature of sample P587.

Ash chemistry from such Western coals (Table 7.) indicate high silica content, low iron oxide and high aluminium oxide. This reflects the absence of pyrite and the predominance of quartz and clays in the coal mineralogy. As a result, the Hardgrove Grindability values and the ash fusion temperatures are much higher than for Eastern coals.

Rock-Eval Pyrolysis

Table 7 reveals the trends in ultimate analysis and pyrolysate yields for the three size fractions of Eastern and Western bituminous coals.

Our findings for Rock-Eval analysis of coal compare with Peters (1986). The Hydrogen Index is less than 300 mg/g of T.O.C. Based on geochemical parameters, this would make these coals a potential source for oil and gas (HI from 150-300) with Eastern bituminous more oil-prone than Western bituminous. But Peters (1986) would consider these values an overestimation.

For the Prince coal, the HI shows a gradual increase towards smaller coal particles more corresponding to a decrease in T.O.C. This correlates with the decrease in elemental from ultimate analysis. In contrast, the HI shows a decrease for smaller particles and an increase in T.O.C. for the Balmer Seam. Furthermore, the T.O.C. values do not correlate with elemental C.

It seems that the -20 mesh coal, being at higher rank (Ro = 1.43), does not oxidize to completion during Rock-Eval analysis and; therefore, the T.O.C. values are too low. The HI calculated from T.O.C. are correspondingly too high. If this interpretation is correct, the finer -400 mesh sample would better reflect correct pyrolysate yields and indicate a gas prone nature (HI < 150 mg/g).

In the case of Eastern coals, the increase in HI and decrease in elemental C or T.O.C. ma reflect maceral or mineral fractionation. If the exinite is concentrated in fines, this would contribute more heavy hydrocarbons to the S_2 peak on pyrolysis.

The rank differences between East and West shown by vitrinite reflectance values of 0.79% and 1.43% respectively are confirmed by the differences in T_{max} of 428°C and 472°C. This may also reflect the difference in maceral composition. As previously discussed, the higher exinite in Eastern coal would burn at a lower temperature than the higher semi-fusinite component of Western coal.

This data suggests that Rock-Eval pyrolysis is a rapid and useful to technique that should be further investigated for coal combustion studies.

Coal Mineralogy and Morphology; Hub Seam (P743)

Photomicrographs of pelletized and polished coal, viewed under backscatter electron imaging, show relatively mineral-depleted grains with dessication cracks and faint bedding textures. Tiny cleats and microfractures are partially mineralized with epigenetic pyrite. Finely dispersed pyrite crystals and globules lie parallel to the weak bedding. These pyrites predate the cleat fillings, having grown syngenetic with peat formation.

Some of the pyrite clusters show radiating "rosette" textures that may illustrate immature crystallinity and an intergrowth with marcasite. Other grains yield EDX spectra with depleted sulphur. This may be pyrrhotite (rare) or may indicate partial oxidation to one of a variety of hydrated sulphates.

Kaolinite dominates the clays, with lesser illite. An unknown mineral, tentatively identified as "staurolite" occupies intercellular fusinite breccia and is likely syngenetic. Other mineralogy is too dispersed and rare for manual observation.

Coal Mineralogy and Morphology; Balmer Seam (P587)

In SEM backscatter imaging, the -20 mesh coal from the Balmer Seam, show highly mineralized grains with very heterogeneous textures. Some grains are essentially bands

(<50 micron thick) dominated by kaolinite. The carbargilites show interlaminated and crenulated clay-maceral bodies, some with the "graupen" texture common in tonsteins.

Quartz is present as lone subrounded grains, of likely detrital parentage. Siderite, with traces of Mg (rhodochrosite) and Mn (magnesite) and illite occur as occasional large grains (20 - 100 um), also detrital. Trace minerals include rutile, as inclusions in kaolinite.

Coal Maceral Chemistry: P743, P587

Xray microanalysis on mineral-free macerals yielded EDX distinctive for the two coals. Both showed a large "Bremsstrahlung" background but at 50 second spot analyses, the Eastern coal yielded higher channel counts. This is shown by the vertical full scale (VFS) used in the spectral charts (Appendix). The element peaks above background, also differ as follows:

Coal		VFS	Elements Above Background
East P743	1.	1024	S > Fe > Cl > Si
	2.	1024	S > Fe > Cl > Si
	3.	1024	S > Fe > Cl > Si > Ca
West P587	1.	512	Fe > S > Si > Al
	2.	512	Fe > S > Si

This may be partially due to SEM settings at the time of analysis, but since most are standardized, the coal character may be in control.

Coal Ultrafines: P587, P473 at -400 mesh

A -400 mesh coal should be within the resolution of the SEM backscatter imaging for particles from 0.5 to 38 microns. Our photo-micrographs, taken on particles mounted on Nuclepore filters, and glass slides showed most of the material to be as submicron size. When mounted as leucite pellets, this ultrafine coal was much finer than the mounting media and not suitable to polish. Free particles were subject to electron charging in the SEM beam if mounted on gold coated glass. Further work is needed to optimize sample preparation.

Cold resin mounts were more suitable for polishing and were used in the SEM-EDX-AIA programme. No morphological information was possible due to the poor resolution. The distribution of "bright" grains in BEI was sparce, suggesting that these coal samples were biased by sieving, with concentration of macerals in the submicron fraction. Alternatively, the small size limits the backscatter signal. For particles <0.5 microns, the BEI signal drops linearly with particle diameter.

Automated Particulate Analysis: Balmer Seam (P587)

Table 8 compiles the mineral identifications given by the FRC analyses in the Appendix. The -20 mesh material represents the whole coal while the -200 and -400 have been

Table 8. Minerals included in Bituminous coal: Balmer Seam (P587). PRC = Particles sized and microanalysed. SEM = identified manually by SEM and EDX. ?? = uncertain. * = present.

MINERAL # grains	CRUSHED COAL (-20 mesh)			PULVERIZED (-200 mesh)		MICRONIZED (-400 mesh)	
	SEM	PRCx50	PRCx500	PRCx50	PRCx500	PRCx50	PRCx500
# per field		605	402	11	9	31	35
pyrite						1	
kaolinite	*	156	344	55	33	48	18
illite	*	16	29	4	6	6	2
quartz	*	101	35	23	24	32	11
siderite	*	7	2	1	2		
calcite		2	1				
ankerite				1			
rutile	*	4	2				1
apatite		12	1	2		2	1
monazite		3	2				
sphalerite			1				
chalcopyrite		2	3				
illite +Ti		1	1				1
zircon		11	20		2		1
Unknowns (%)		28.9	28.6	17.59	30	12.2	31.4

Table 9. Minerals in Bituminous coal: Sydney Basin (P743). PRC = Particles sized and microanalysed. SEM = identified manually by SEM and EDX. ?? = uncertain. * = present.

MINERAL # grains	CRUSHED COAL (-20 mesh)			PULVERIZED (-200 mesh)		MICRONIZED (-400 mesh)	
	SEM	PRCx50	PRCx500	PRCx50	PRCx500	PRCx50	PRCx500
# per field		230	220	14	18	7	8
pyrite	*	195	71	36	26	6	1
FeS (??)	*	17	6	1	2	1	
sulphur		5	2	1			
kaolinite	*	38	12	32	23	1	1
illite	*	47	9	10	8	3	3
quartz		18	11	3	3	1	
gypsum		1		1	1		
halite		2	1	3			
siderite					1		
calcite				1			
ankerite			1				
dolomite			3				
apatite			2				
monazite					1		
chalcopyrite					2		
illite +Ti		4			2		
zircon		1			2		
staurolite(??)	*						
Unknowns (%)		28.8	23.9	13.23	28.6	32.9	24.2

Note: x50, x500 refer to SEM field magnification.

sieved with inherent mineral bias. Major mineralogy for all fractions is kaolinite and quartz, with minor illite, including a Ti-bearing variety.

In the crushed coal, kaolinite greatly dominates the fines (0.5 - 7.5 um) but shows a 3:2 ratio with quartz in the larger fractions (5.0 - 30 um). We would therefore anticipate that on sieving, the micronized fraction would be primarily kaolinite and macerals. This would explain the very poor BEI imaging for -400 mesh coal, since the BEI signal from kaolinite is weaker than most other minerals. On the otherhand, our results from PRC for micronized coal suggest quartz present in almost similar amounts. Because of the low particle count for SEM fields of view for both -200 and -400 mesh samples, these results are suspect. The poor BEI imaging for small particles has likely biased results towards recognition of quartz.

Some 29% of particles in the -20 mesh coal remain unidentified. This is attributed to particle overlaps and low Xray counts rather than to the presence of other minerals not tabulated. The absence of pyrite as well as other FeS species, is noteworthy. Most sulphur must therefore be locked in the organic matrix.

Trace minerals apatite, zircon and monazite are present in sufficient frequency to account for much of the trace element contents reported by Goodarzi et al (1985) in similar coals.

Automated Particulate Analysis: Hub Seam (P743)

Table 9. compiles the PRC results for the Eastern coal, as given in the Appendix. As previously stated, the -20 mesh sample represents the whole coal, while -200 and -400 mesh are sieve recoveries. The number of mineral grains is substantially less per SEM field than for the Western coal (230, 220 versus 605, 402) when -20 whole coal is considered.

Pyrite dominates the -20 mesh mineralogy but is matched by kaolinite in the 200 - 400 mesh size. This suggests that incomplete comminution has biased the coarser samples with more resistant pyrite grains and concentrated the kaolinite in fines. The clays may also have been biased : illite is the dominant clay in the whole coal but is outnumbered by kaolinite in fines.

The major minerals for this coal are: pyrite, kaolinite, illite and quartz. A sulphur depleted variety of Fe-S mineral is also indicated, either as "pyrrhotite" or as a hydrated sulphate. Some spectra suggest pure sulphur which could be native S or maceral based organic S. Traces of carbonates and marine minerals (gypsum, halite) are detected in addition to refractory zircon, monazite and apatite.

Approximately 25% of the coal inclusions were not identified, due to particle overlap, weak Xray signal, or unclassified mineralogy. When viewed manually, we detected an unusual mineral, filling maceral breccia and yielding Al-Si-Fe chemistry. It is interesting to note that semi-quantitative XRD also reported an unknown mineral. A tentative identification of "staurolite" is applied.

Combustion Residue: Balmer Ash

Particulate mounts of 850°C ash from a reduced burn, showed numerous spherical structures and hollow globular textures, indicative of rapid devolatilization. Remnant coal maceral textures indicated incomplete burn and a "coke" residue, rather than ash.

A manual search yielded numerous trace minerals not reported from coal mineralogy. This may be fortuitous or may indicate trace minerals crystallized from elements released by the organic matrix. The automated PRC did not confirm this hypothesis.

When analysed by PRC, the pelletized residues yielded higher particle counts per SEM field for the -200 mesh coal. This may indicate agglomeration. The -20 mesh ash yielded similar counts to the original coal. The percentage of unknown particles remained the same.

The major mineral suite did not show alteration by combustion. The kaolinite > quartz > illite mineralogy was retained for burns at 850 and 1100°C at both atmospheres. This is in agreement with the findings of Huggins _et al_. (1982), that only degassing and dehydration occur. The trace

Table 10. Minerals identified in Bituminous Ash: Balmer Seam (P587).
Muffle furnace combustion at 850-1100 C in O2 or CO:CO2.
PRC = Particles sized and microanalysed. SEM = identified manually by SEM and EDX. ?? = uncertain. * = present.

MINERAL	CRUSHED COAL (-20 mesh)			PULVERIZED			(-200 mesh)			
# grains										
BURN TYPE:										
Temperature	850	850	850	850	1100	1100	850	850	1100	1100
Atmosphere	red	red	red	red	red	red	oxy	oxy	oxy	oxy
ANALYSIS:										
Method	SEM	PRCx50	PRCx500	SEM	PRCx50	PRCx500	PRCx50	PRCx500	PRCx50	PRCx500
# per field		537	660		506	607	1154	658	1120	512
MINERALS: (# grains)										
kaolinite	*	63	186	*	71	102	194	39	134	69
illite	*	10	15	*	19	14	29	6	18	21
quartz	*	62	117	*	30	34	84	16	58	32
siderite	*		2	*	2	1	8	1		1
calcite	*	5	1	*			1			
smectite							1			
ankerite									2	1
chlorite									1	
halite									1	
rutile	*			*			1	1	1	
apatite	*	1	1	*	1	1	6	1	4	
monazite				*		1	2		1	2
sphalerite										
chalcopyrite										
illite +Ti	*	2	2	*	2	2	7	1	2	3
zircon					1	1	6			9
Ba-Sr				*						
galena(?)				*						
cassiterite (??)				*						
xenotime				*						
Si-Ba-Ce				*						
plagioclase(??)				*						
Ca-S	*			*						
Fe-Si				*						
Fe-Si-Ca				*						
glass sphere				*						
UNKNOWNS (%)		27.4	18.3		24.1	20.75	23.7	12.8	24.6	36.1

Table 11. Minerals identified in Bituminous Ash: Hub Seam (P743)
Muffle furnace combustion at 850 C, in oxygen or CO:CO2.
PRC = Particles sized and microanalysed. SEM = identified manually by SEM and EDX. ?? = uncertain. * = present.

SAMPLE:	CRUSHED COAL (-20 mesh)		PULVERIZED (-200 mesh)		
BURN TYPE:					
Temperature	850	850	850	850	850
Atmosphere	red	red	red	oxy	oxy
ANALYSIS:					
Method	PRCx50	PRCx500	SEM	PRCx50	PRCx500
# per field	203	77		310	249
MINERALS (# grains)					
pyrite	4	4	*	13	11
FeS (?)	9	6		22	17
sulphur				1	
kaolinite	20	24		18	7
illite	28	18	*	13	6
quartz	18	10	*	3	1
siderite	8	5	*	5	2
calcite				1	
smectite			*		1
chlorite			*		
gypsum				4	
halite		1			
rutile	1				1
apatite				2	
monazite					2
sphalerite				1	
chalcopyrite					5
illite +Ti		4		2	3
zircon					3
UNKNOWNS (%)	15.7	25.8		25.5	35.3

minerals are too scarce to show statistically significant changes.

The detectable mineralogical changes include sulphur capture by a Ca-mineral, likely due to calcite conversion to $CaSO_4$. Since pyrite is so rare, this may have been organic sulphur, released by combustion.

Other changes include the development of spheres and vesicular coke. A low burn temperature is indicated by the coke texture, but some illites must have achieved melt conditions.

Combustion Residue: Hub Ash

Polished mounts of reduced 850°C ash, show relatively smooth coke with minor vesicular formation. The coke elemental spectrum differs considerably from the original coal. Chlorine has disappeared while Al and K become significant contributors:

	Grain	VFS:	Peaks:
coke	1.	2048	S > Fe > Si > Al > Ca
coke	2.	2048	Si = Al = S > Fe > K > Ca

Spectra for clays also suggest some changes with the appearance of traces of Na, Mg and Ca. This may be an elemental scavenging event or simply limited sampling of trace minerals.

Most minerals appear to have survived combustion intact, remaining encapsulated by the macerals or coke. Even pyrite appears to have survived in part at 850°C (reducing). This suggests that the burn conditions in the muffle furnace did not reach the temperatures assumed from the settings. Pyrite should have decomposed by 600°C.

When polished pellets were analysed by the FRC programme, the number of mineral particles counted per SEM field increased over counts on coal. The percentage of unknown particles remained at approximately 25%.

The iron species of minerals showed the largest changes from original coal. Pyrite decreased to minor amounts and proportionally the sulphur-depleted mineral (FeS?) increased. The "Siderite" category also increased, which likely indicates a combustion oxide (magnetite) rather than residual carbonate.

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APPENDIX "I"

DATA TABLES

TABLE 1. ASH AND SULPHUR RESULTS -20 mesh splits

REGION	I.D.	ASH (as determined)	SULPHUR (as determined)
EASTERN CANADA	P-743	1.94	1.73
WESTERN CANADA	P-587	9.71	0.08

Table 2. X-RAY DIFFRACTION REPORT ON 2 SAMPLES *

1. SAMPLE P587
   A GENERAL X-RAY DIFFRACTOGRAM SHOWS THE PRESENCE OF SEVERAL MINERALS:
   - MAJOR QUARTZ (20-30%)
   - MAJOR KAOLINITE (60-70%)
   - TRACE PYRITE (<5%)
2. SAMPLE P743
   A GENERAL X-RAY DIFFRACTOGRAM SHOWS THE PRESENCE OF SEVERAL MINERALS:
   - MAJOR PYRITE (20-30%)
   - MAJOR QUARTZ (10-20%)
   - MAJOR KAOLINITE (30-40%)
   - MINOR UNIDENTIFIED MINERAL (5-10%)

*LOW TEMPERATURE ASH FROM -20 MESH WHOLE COAL

Table 3.

MACERAL ANALYSIS P-743 EASTERN CANADA Ro max = 0.79%

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	77.2	77.2	91.8
	EXINITE	SPORINITE	10.2	13.6	
		CUTINITE	0.6		
		RESINITE	2.8		
	SEMI-FUSINITE	REACTIVE SEMIFUSINITE	1.0	1.0	
INERT	SEMI-FUSINITE	INERT SEMIFUSINITE	2.0	2.0	8.2
	INERTINITE	FUSINITE	1.4	5.2	
		MACRINITE	1.0		
		MICRINITE	2.4		
		SCLEROTINITE	0.2		
		INERTODETRINITE	0.2		
	MINERAL MATTER	PYRITE	0.0	1.0	
		QUARTZ	0.2		
		CLAYS	0.8		
		CARBONATES	0.0		

Table 4.

MACERAL ANALYSIS P-587 WESTERN CANADA Ro max = 1.43%

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	57.2	57.2	68.5
	EXINITE	SPORINITE	0.0	0.6	
		CUTINITE	0.0		
		RESINITE	0.6		
	SEMI-INERTINITE	REACTIVE SEMI INERTINITE	10.7	10.7	
INERT	SEMI-INERTINITE	INERT SEMI INERTINITE	21.5	21.5	31.5
	INERTINITE	FUSINITE	2.2	3.8	
		MACRINITE	1.2		
		MICRINITE	0.0		
		SCLEROTINITE	0.2		
		INERTODETRINITE	0.2		
	MINERAL MATTER	PYRITE	0.0	6.2	
		QUARTZ	0.2		
		CLAYS	6.0		
		CARBONATES	0.0		

Table 5.

VITRINITE REFLECTANCE DATA POINTS FOR COAL COMBUSTION STUDY

P-743 EASTERN CANADA

```
.88  .87  .84  .84  .83  .83  .83  .83  .83  .83  .82  .82  .82  .82  .81  .81
.81  .8  .8  .8  .8  .79  .79  .79  .79  .79  .79  .79  .79  .78  .78  .78
.78  .78  .77  .77  .77  .77  .77  .76  .76  .75  .75  .75  .75  .75  .74  .74
.73  .67
```

P-587 WESTERN CANADA

```
1.56  1.54  1.53  1.53  1.53  1.52  1.52  1.52  1.51  1.51  1.5  1.49  1.49
1.49  1.49  1.49  1.49  1.48  1.47  1.47  1.47  1.47  1.46  1.45  1.45  1.45
1.45  1.44  1.42  1.42  1.42  1.42  1.39  1.39  1.38  1.38  1.38  1.38  1.37
1.36  1.36  1.36  1.34  1.34  1.34  1.33  1.31  1.3  1.29  1.26
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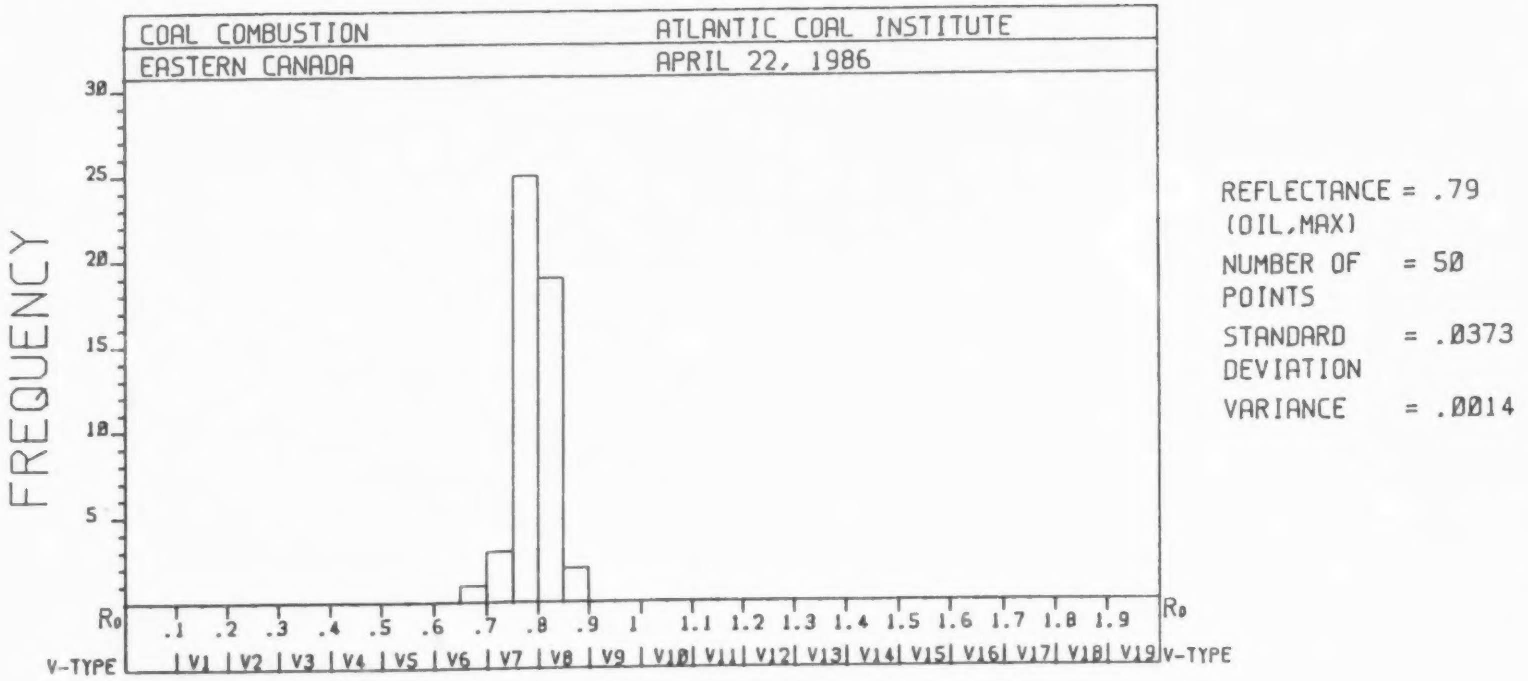
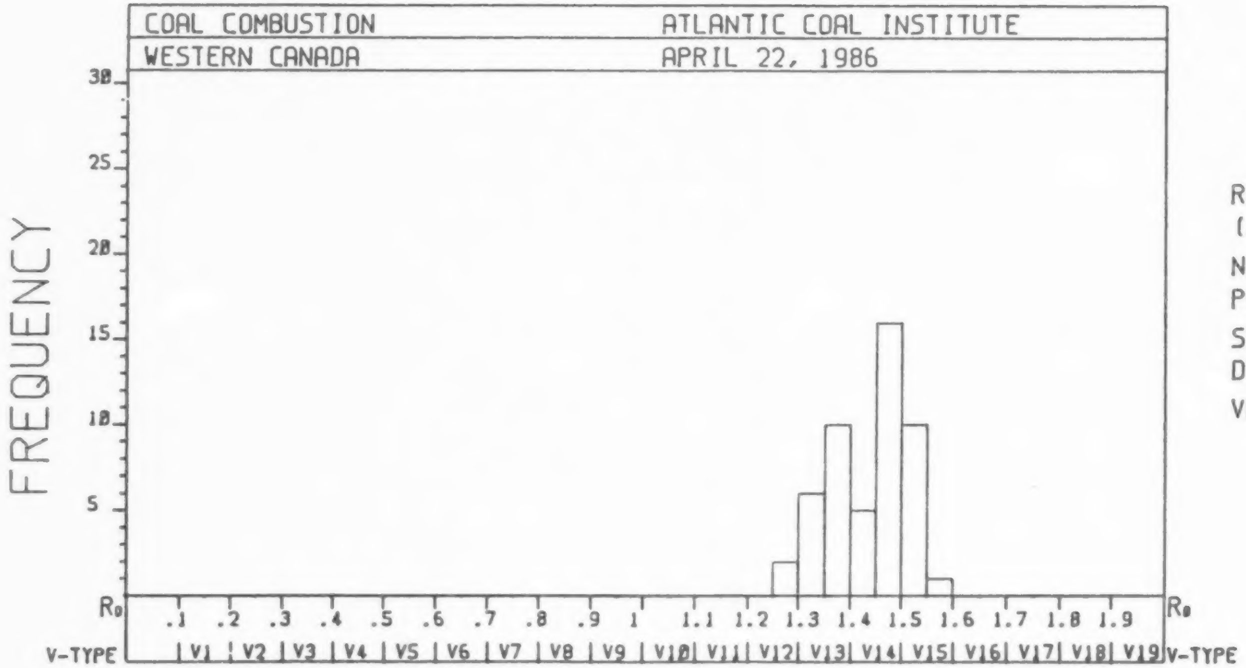

COAL COMBUSTION
ATLANTIC COAL INSTITUTE
EASTERN CANADA
APRIL 22, 1986
FREQUENCY
30
25
20
15
10
5
Ro
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Ro
V-TYPE
V1
V2
V3
V4
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
V15
V16
V17
V18
V19
V-TYPE
REFLECTANCE = .79
(OIL,MAX)
NUMBER OF POINTS = 50
STANDARD DEVIATION = .0373
VARIANCE = .0014

Figure 1.



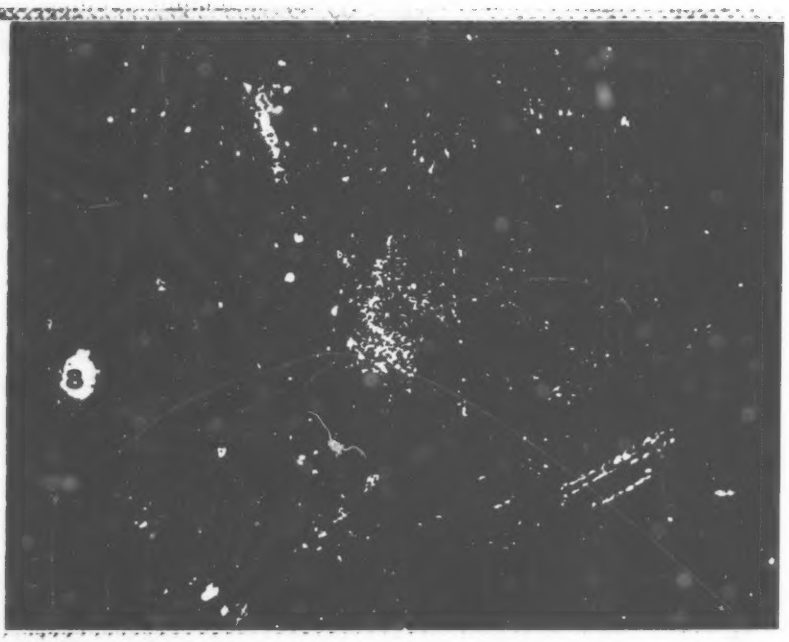
REFLECTANCE = 1.43
(OIL,MAX)
NUMBER OF POINTS = 50
STANDARD DEVIATION = .0747
VARIANCE = .0056

Figure 2.

APPENDIX II

PHOTOMICROGRAPHS: Plate #1
Western Canadian P587 coal
-20 mesh, in polished pellet

1.	0214-01	35X, BEI Coal grains in leucite pellet matrix. Abundant bright grains are mineral inclusions.
2.	0214-02	150x, BEI Enlarged from 1. Note the bimodal particle sizes. Large grains as "bands" with micron size grains in matrix.
3.	0214-03	150X, BEI Enlarged from 1. This illustrates the heterogeneous distribution of mineralogy.
4.	0214-04	150X, BEI Enlarged from 1. Note "clean" coal adjacent to the carbominerite band. The circular texture is an artifact of pellet mounting.
5.	0214-05	350X, BEI Enlarged from 2. Kaolinite "graupen" are similar to those of a tonstein. Quartz is present as subrounded detrital grains.
6.	0214-06	350X, BEI Enlarged from 3. Complex crenulations of kaolinite and macerals.
7.	0214-07	350X, BEI Field of view analysed by automated SEM-EDX-image analysis.



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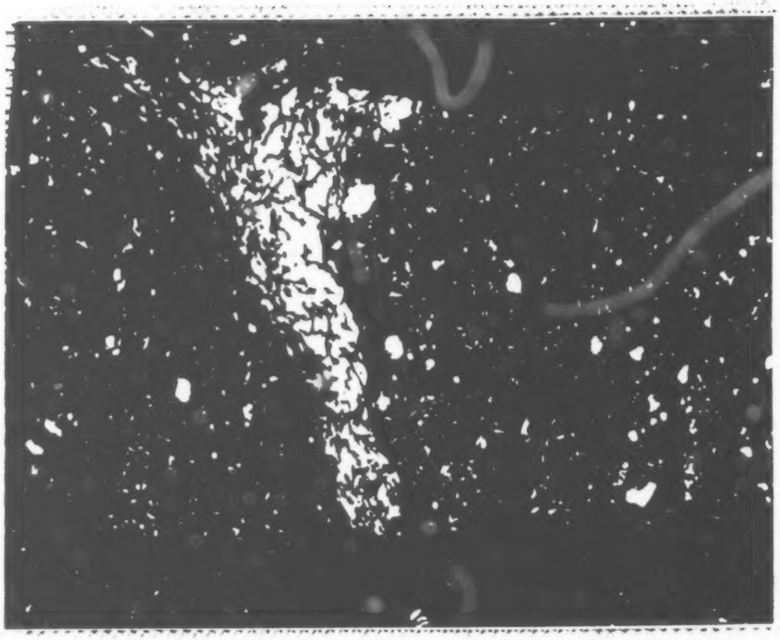

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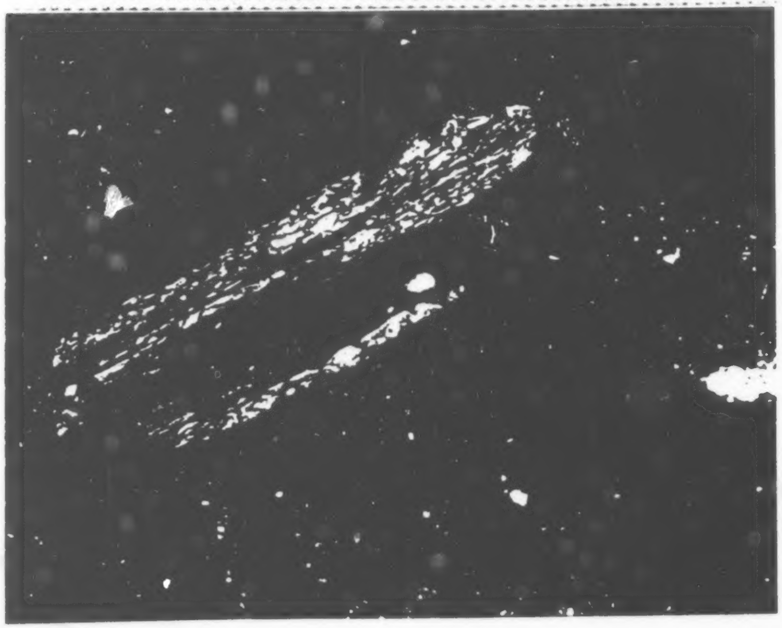

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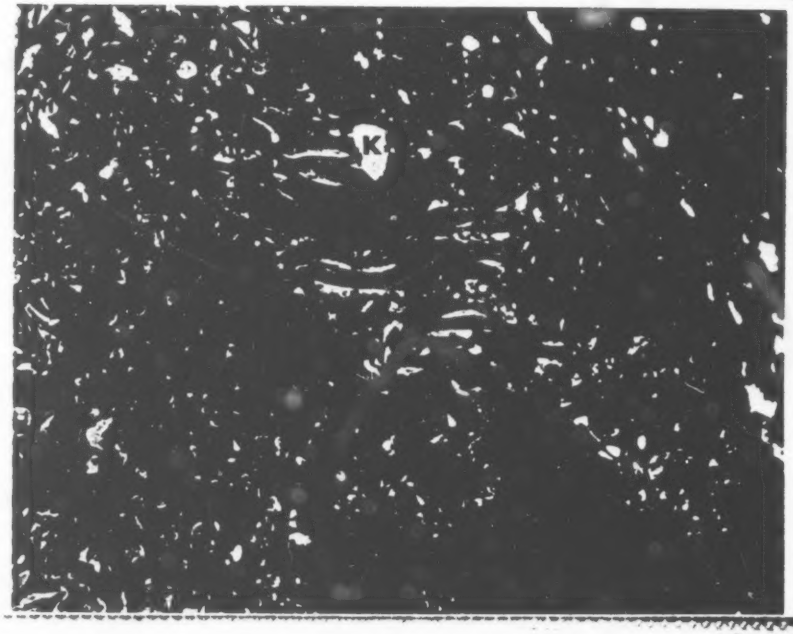

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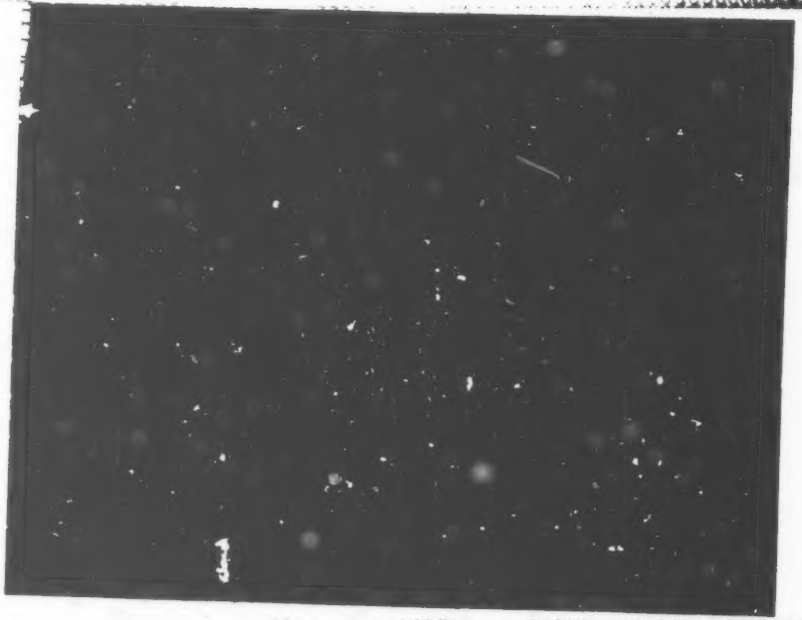

EDX SPECTRA SET #1
Western Canadian Coal crushed to -20 mesh
Spectra at 20Kv, spot mode, 50 seconds

1. Kaolinite

2. Quartz

3. Coal maceral with large background. Note the low count rates (VFS=512). This coal is relatively lean with respect to inorganic elements. Some iron, silica and sulphur are present but much less than for the Eastern coal.

4. Coal maceral (as above). Note low count rate.

5. Siderite or hematite.

6. Rutile crystals associated with kaolinite.

7. Illite

8. Siderite (?) with traces of Mg, Mn, Ca. Likely an isomorphous series with rhodochrosite ($MnCO_3$) and magnesite ($MgCO_3$). Traces of Ca can substitute also.

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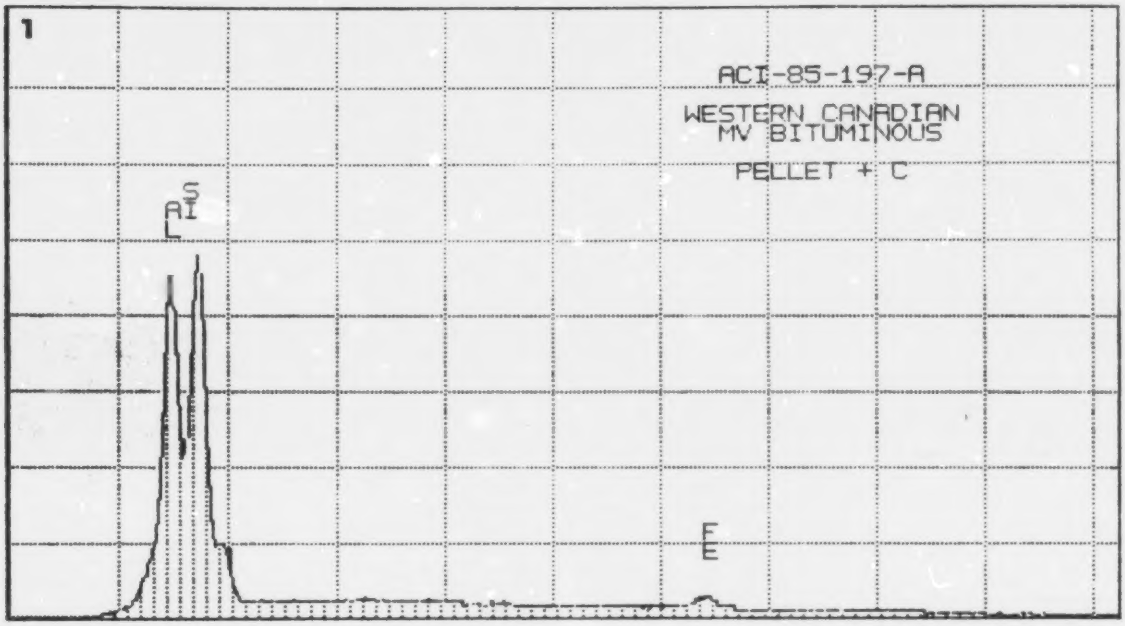

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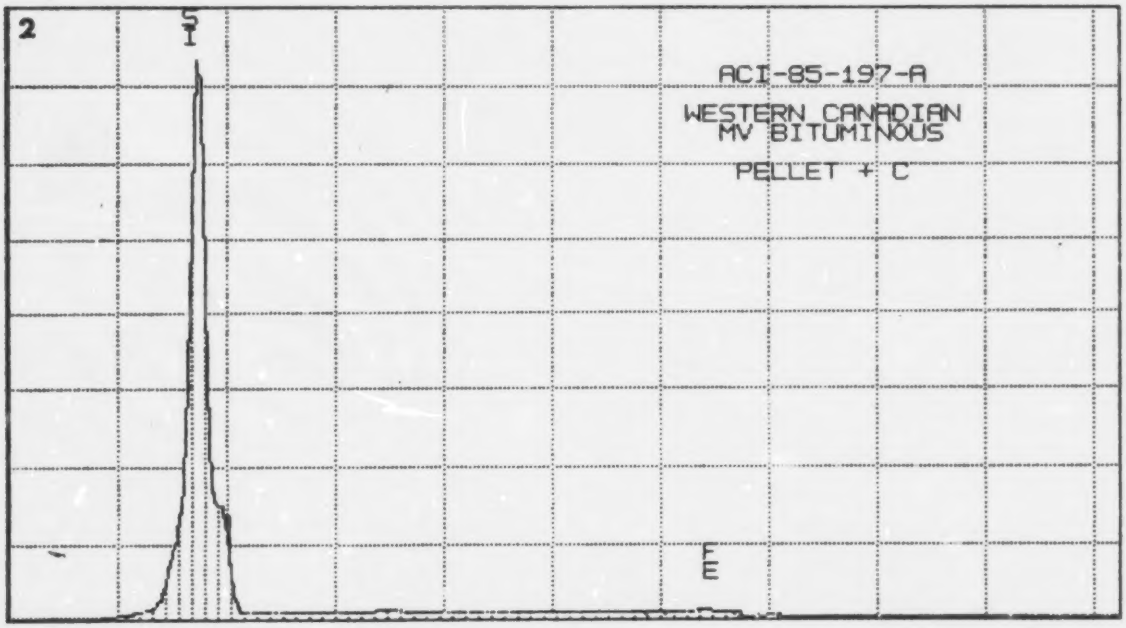

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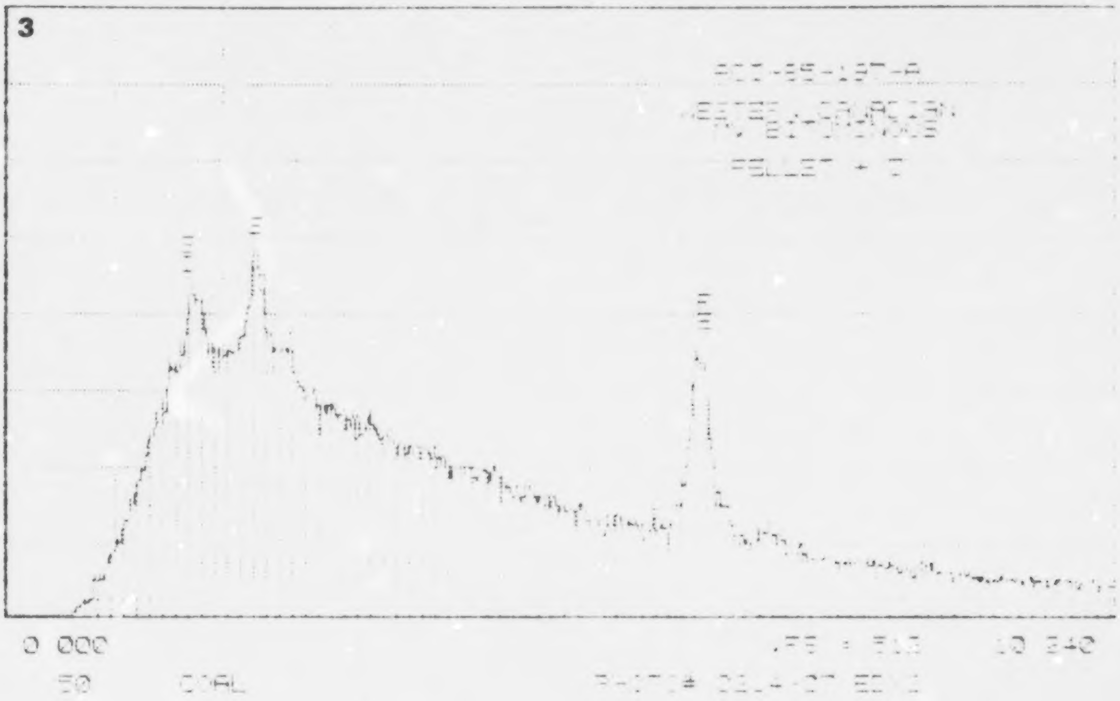

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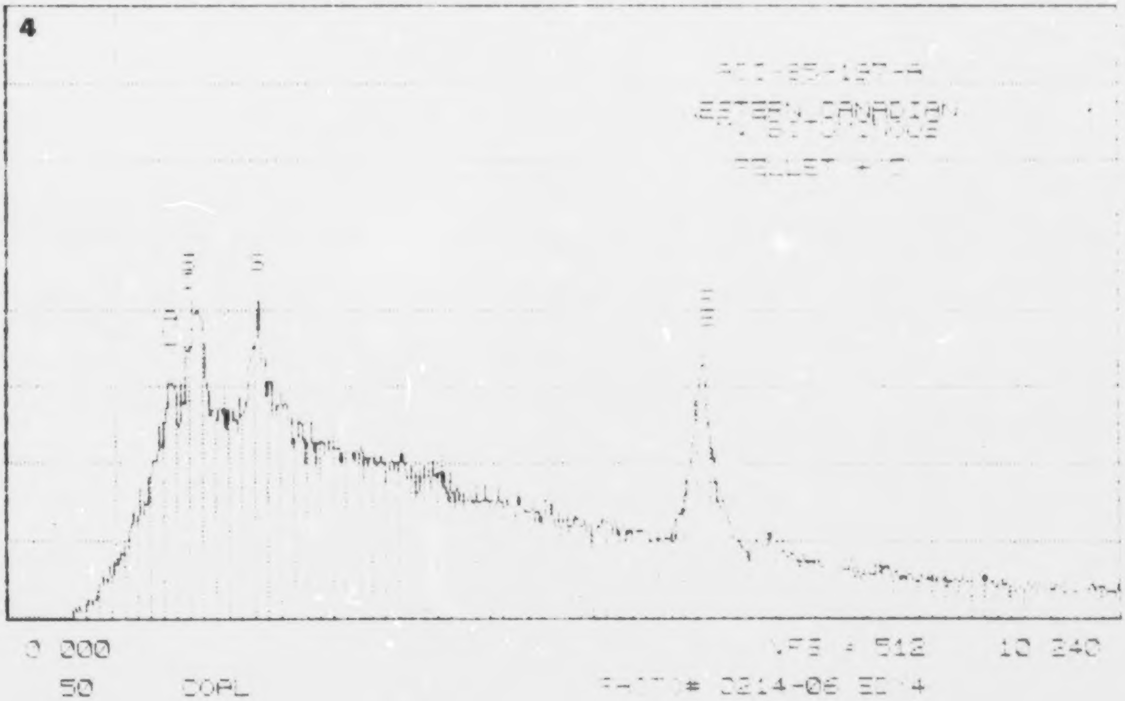

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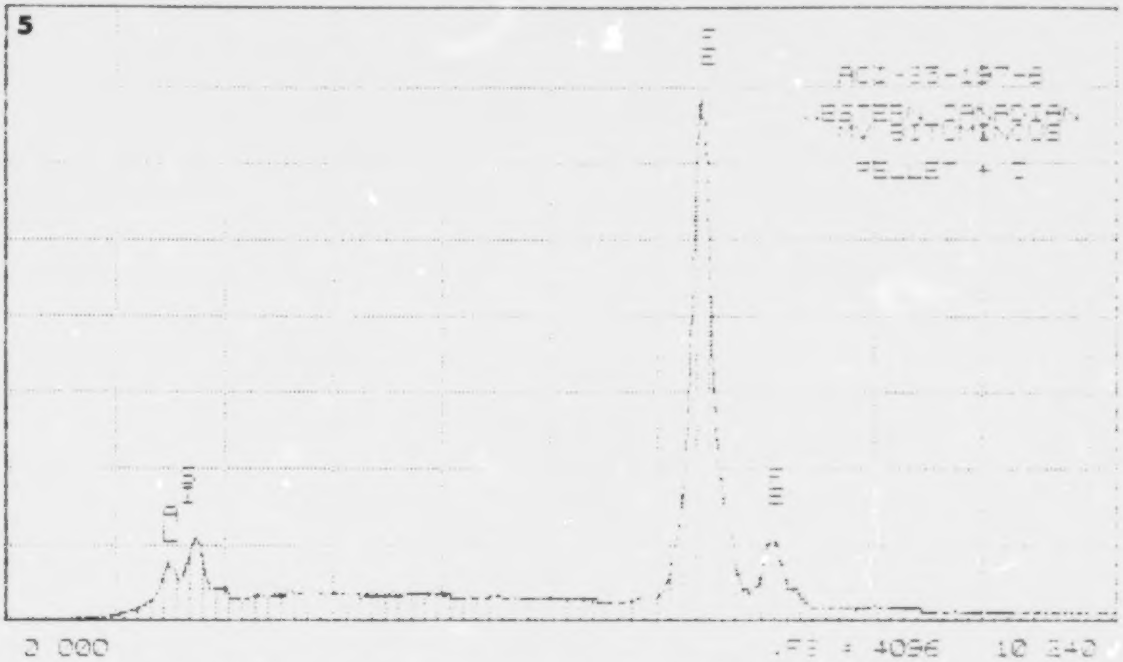

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ATLANTIC COAL INSTITUTE FRI 14-FEB-86 12:04
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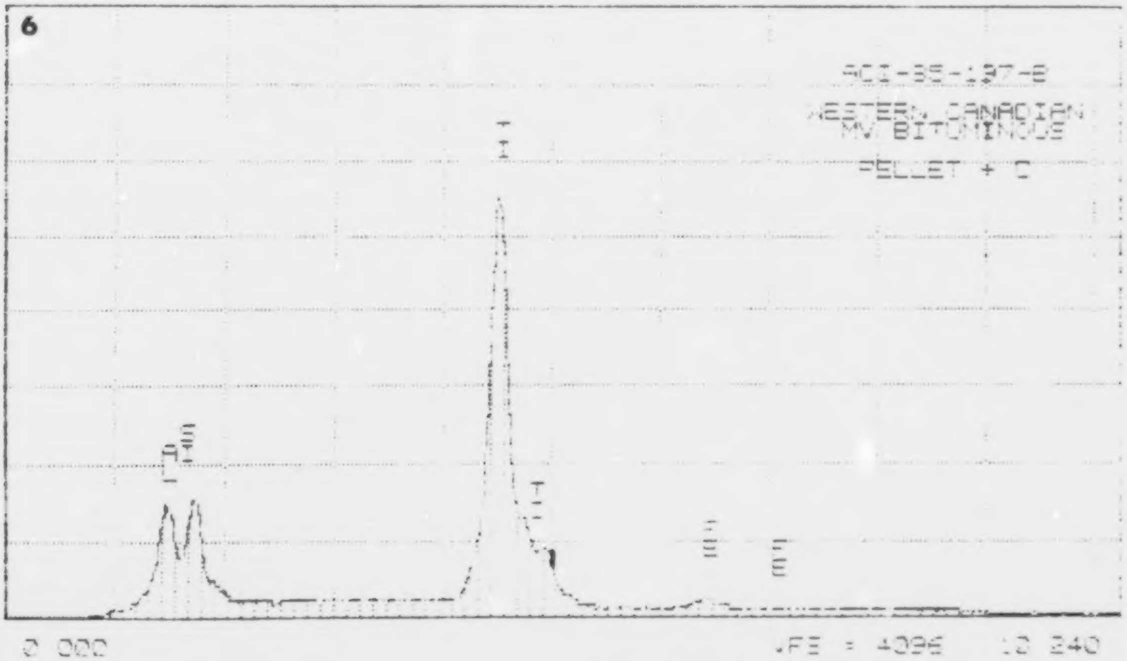
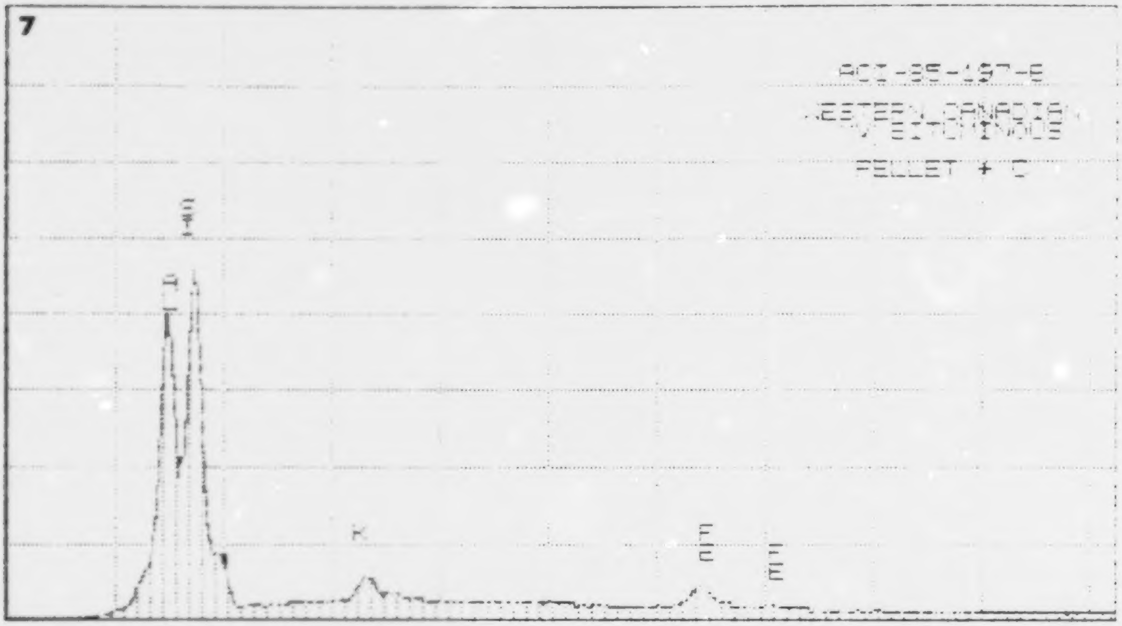


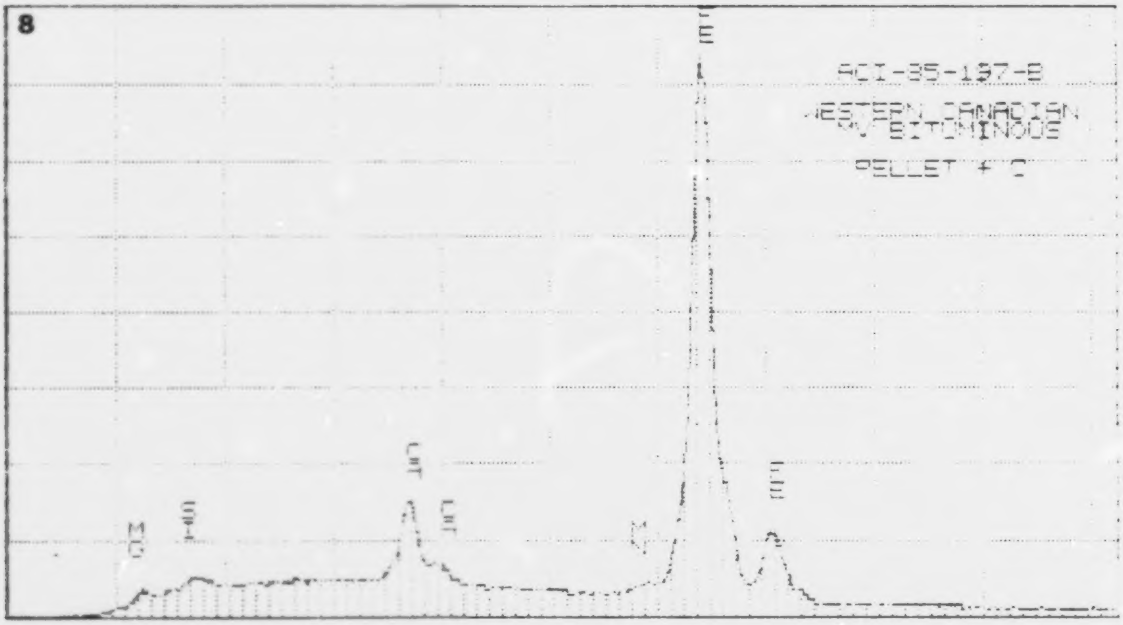
50 MINERAL: PHOTO# 0214-05.ED 6

ATLANTIC COAL INSTITUTE FRI 14-FEB-86 12:15
Cursor: 0.000keV = 0



0.000 VFS = 4096 10.240
51 MINERAL: PHOTO# 0214-01.EDX7

ATLANTIC COAL INSTITUTE FRI 14-FEB-86 14:33
Cursor: 0.000keV = 0



0.000 VFS = 4096 10.240
MINERAL: PHOTO# 0214-01.EDX8 52

PHOTOMICROGRAPHS PLATE #2
Western Coal: P587
-400 mesh (micronized)

1. 0710-13 35X SEI 20 Kv Coal particles on Au coated glass slide

2. 0710-16 35X BEI as above 20 Kv.

3. 0710-14 100X SEI 20 Kv. as above. Bright grains are due to charging rather than high Z.

4. 0710-17 100X BEI. as above.

5. 0711-01 35X SEI 20 Kv. Particles dispersed on nuclepore filter by droplet evaporation. Note halos due to charging.

6. 0711-04 35X BEI. Note lack of bright grains (i.e. high atomic number, Z).

7. 0711-02 100X SEI. Bright grains due to charging

8. 0711-04 100X BEI. Note scarcity of bright grains (high Z). Grains previously "bright" (photo 0711-02) now show low contrast (low Z), typical of coal.

9. 0711-03 1000X SEI 20Kv. Particles dispersed on nuclepore filter. Except for a few grains, the majority of particles are submicron.

10. 0711-06 1000X BEI 20 Kv. as above. Only the largest grains are within resolution of the backscatter electron imaging.

11. 0710-15 1000X SEI 20 Kv. Particles evaporated on Au coated glass slide.

12. 0710-18 1000X BEI 20Kv. as above. Note that submicron particles are not resolved by the BEI.

Western Coal P587 -200 mesh

13. 35X, BEI. This field of view shows the highest concentration of bright grains.

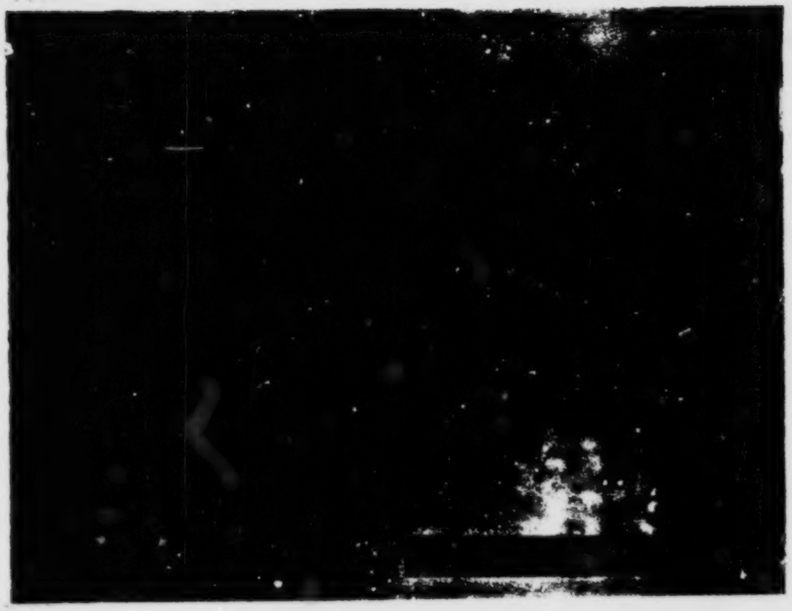
2

4

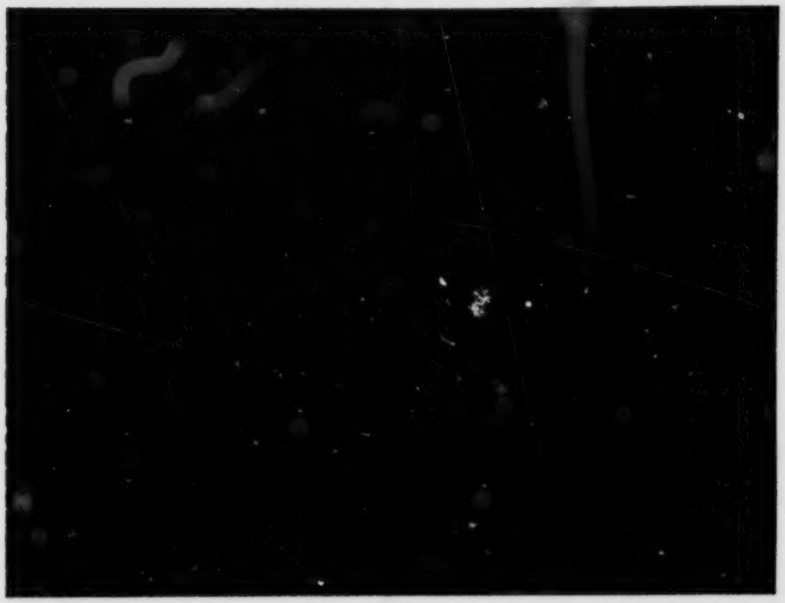
1

3

5



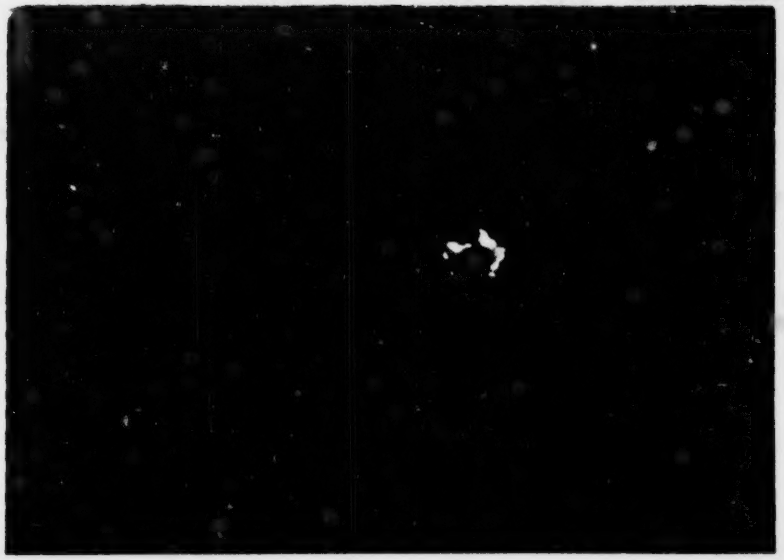
6



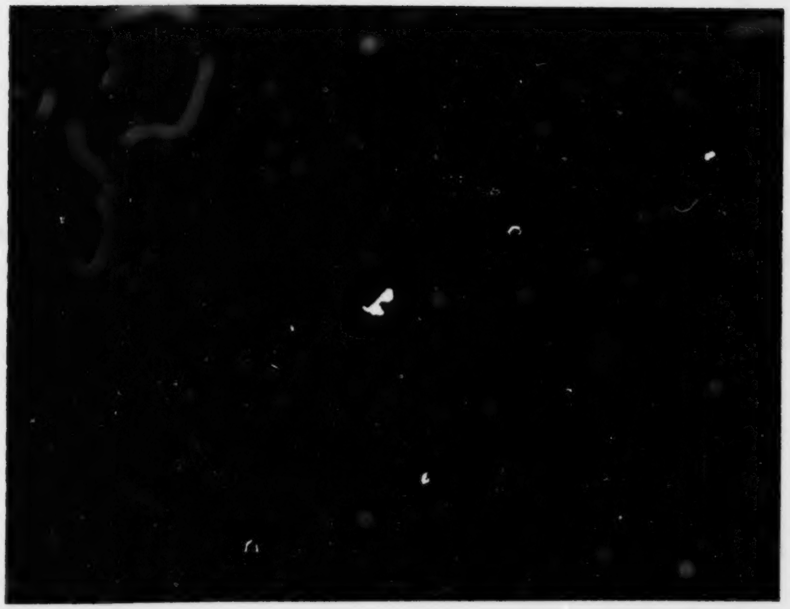
7

8

9



10



11

12

```
PRC: REPORT
                                                     LABEL: 85-197-P587-20-UNALTERED  50X
                                                     MAGNIFICATION=                 50
                                                     GUARD REGION=              15.000 microns
SUMMARY OF RESULTS                                   MINIMUM PARTICLE SIZE=      5.000 microns
                                                     MAXIMUM PARTICLE SIZE=     30.000 microns
LABEL: 85-197-P587-20-UNALTERED  50X                 LOW SHAPE FACTOR=           1.000
NUMBER OF FRAMES              1                      HIGH SHAPE FACTOR=          7.000
NUMBER OF PARTICLES         605
MAGNIFICATION                50
FIELD WIDTH=            1799.56 um
OFF PARTICLE SPACING=      4.83 um                     THRESHOLDS:  LOWER=  53  UPPER= 255
ON PARTICLE SPACING=       0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE          NAME                AVE.DIA.             MAX        MAX/MIN      AREA      PERIMETER
                                  MICRONS              MICRONS                 uM^2      MICRONS
  0  ALL TYPES              8.42E+00 +-  3.93E+00   1.43E+01   3.21E+00  7.618E+01  4.083E+01
  2  KAOLINITE              8.85E+00 +-  4.27E+00   1.48E+01   2.97E+00  8.513E+01  4.153E+01
  3  ILLITE                 7.44E+00 +-  2.78E+00   1.39E+01   4.12E+00  5.597E+01  3.809E+01
  4  QUARTZ                 8.84E+00 +-  4.41E+00   1.44E+01   2.63E+00  8.402E+01  3.971E+01
  5  SIDERITE               1.55E+01 +-  6.82E+00   1.94E+01   1.59E+00  2.269E+02  5.650E+01
  6  CALCITE                7.47E+00 +-  6.21E-01   1.25E+01   2.81E+00  5.122E+01  3.515E+01
 14  RUTILE                 1.03E+01 +-  3.13E+00   1.83E+01   3.38E+00  1.000E+02  5.185E+01
 15  APATITE                7.61E+00 +-  2.15E+00   1.12E+01   2.18E+00  5.598E+01  3.175E+01
 16  MONAZITE               9.52E+00 +-  2.53E-01   1.56E+01   2.68E+00  7.898E+01  4.130E+01
 19  CHALCOPYRITE           7.25E+00 +-  1.55E+00   1.16E+01   3.60E+00  4.678E+01  3.999E+01
 22  ILLITE + Ti            7.03E+00 +-  0.00E+00   1.36E+01   3.87E+00  4.847E+01  3.427E+01
 23  ZIRCON                 7.59E+00 +-  2.28E+00   1.54E+01   3.98E+00  5.867E+01  4.290E+01
 24  POLISH                 6.62E+00 +-  1.17E+00   1.16E+01   3.24E+00  4.159E+01  3.250E+01
 62  NON-INT                9.20E+00 +-  4.80E+00   1.66E+01   3.97E+00  9.498E+01  4.877E+01
 63  UNKNOWN                7.90E+00 +-  3.18E+00   1.36E+01   3.48E+00  6.476E+01  4.015E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                     NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                          605     100.00        1.42
  2  KAOLINITE                          156      25.78        0.41
  3  ILLITE                              16       2.64        0.02
  4  QUARTZ                             101      16.69        0.26
  5  SIDERITE                             7       1.15        0.04
  6  CALCITE                              2       0.33        0.00
 14  RUTILE                               4       0.66        0.01
 15  APATITE                             12       1.98        0.02
 16  MONAZITE                             3       0.49        0.00
 19  CHALCOPYRITE                         2       0.33        0.00
 22  ILLITE + Ti                          1       0.16        0.00
 23  ZIRCON                              11       1.81        0.01
 24  POLISH                              49       8.09        0.06
 62  NON-INT                             66      10.90        0.19
 63  UNKNOWN                            175      28.92        0.34
```

```
                              FILE NO.?30        LABEL: 85-197-P587-20-UNALTERED    500X
SUMMARY OF RESULTS                               MAGNIFICATION=                    500
                                                 GUARD REGION=                  4.000 microns
LABEL: 85-197-P587-20-UNALTERED    500X          MINIMUM PARTICLE SIZE=         0.500 microns
NUMBER OF FRAMES                  2              MAXIMUM PARTICLE SIZE=         7.500 microns
NUMBER OF PARTICLES             804              LOW SHAPE FACTOR=              1.000
MAGNIFICATION                   500              HIGH SHAPE FACTOR=             7.000
FIELD WIDTH=                 179.95 um
OFF PARTICLE SPACING=          0.48 um            THRESHOLDS:  LOWER=  86  UPPER= 255
ON PARTICLE SPACING=           0.04 um
FIELD AREA=                3.23E+04 um^2
TYPE          NAME                  AVE.DIA.               MAX        MAX/MIN     AREA       PERIMETER
                                    MICRONS                MICRONS                uM^2       MICRONS
  0  ALL TYPES               1.82E+00 +-  1.14E+00    3.27E+00   3.21E+00  4.072E+00  8.393E+00
  2  KAOLINITE               2.14E+00 +-  1.29E+00    3.89E+00   3.29E+00  5.525E+00  9.863E+00
  3  ILLITE                  1.75E+00 +-  7.96E-01    3.19E+00   3.43E+00  3.251E+00  8.278E+00
  4  QUARTZ                  1.96E+00 +-  1.48E+00    3.06E+00   2.17E+00  5.036E+00  8.069E+00
  5  SIDERITE                3.64E+00 +-  2.42E+00    5.95E+00   2.28E+00  1.355E+01  1.487E+01
  6  CALCITE                 2.68E+00 +-  0.00E+00    4.39E+00   2.70E+00  6.212E+00  1.059E+01
 14  RUTILE                  1.88E+00 +-  1.30E+00    2.28E+00   1.50E+00  3.559E+00  6.569E+00
 15  APATITE                 2.32E+00 +-  0.00E+00    2.72E+00   1.40E+00  4.405E+00  7.822E+00
 16  MONAZITE                7.91E-01 +-  1.24E-01    1.31E+00   2.72E+00  5.948E-01  3.405E+00
 18  SPHALERITE              2.54E+00 +-  0.00E+00    4.39E+00   2.37E+00  5.199E+00  1.234E+01
 19  CHALCOPYRITE            1.42E+00 +-  2.68E-01    2.70E+00   3.06E+00  1.800E+00  6.679E+00
 22  ILLITE + Ti             1.05E+00 +-  0.00E+00    1.18E+00   1.22E+00  8.757E-01  3.515E+00
 23  ZIRCON                  1.39E+00 +-  9.96E-01    2.45E+00   6.33E+00  2.542E+00  6.475E+00
 24  POLISH                  1.49E+00 +-  7.76E-01    2.68E+00   3.07E+00  2.467E+00  7.061E+00
 62  NON-INT                 1.90E+00 +-  1.14E+00    3.95E+00   4.03E+00  4.416E+00  9.916E+00
 63  UNKNOWN                 1.43E+00 +-  7.84E-01    2.45E+00   2.82E+00  2.329E+00  6.388E+00

PARTICLE COUNT SUMMARY
TYPE          NAME              NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                    804     100.00       5.05         TYPE               NO.     %
  2  KAOLINITE                    344      42.78       2.93           2  KAOLINITE     368   45.77
  3  ILLITE                        29       3.60       0.14           3  ILLITE         33    4.10
  4  QUARTZ                        35       4.35       0.27           4  QUARTZ         34    4.22
  5  SIDERITE                       2       0.24       0.04           5  SIDERITE        1    0.12
  6  CALCITE                        1       0.12       0.00           6  CALCITE         1    0.12
 14  RUTILE                         2       0.24       0.01          14  RUTILE          2    0.24
 15  APATITE                        1       0.12       0.00          15  APATITE         2    0.24
 16  MONAZITE                       2       0.24       0.00          22  ILLITE + Ti     3    0.37
 18  SPHALERITE                     1       0.12       0.00          23  ZIRCON          2    0.24
 19  CHALCOPYRITE                   3       0.37       0.00          24  POLISH         59    7.33
 22  ILLITE + Ti                    1       0.12       0.00          62  NON-INT        67    8.33
 23  ZIRCON                        20       2.48       0.07          63  UNKNOWN       232   28.85
 24  POLISH                        66       8.20       0.25
 62  NON-INT                       67       8.33       0.45
 63  UNKNOWN                      230      28.60       0.82
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75       93  11.5 [******
     1.00       95  11.8 [******
     1.25      112  13.9 [*******
     1.50      103  12.8 [*******
     1.75       63   7.8 [****
     2.00       65   8.0 [*****
     2.25       53   6.5 [****
     2.50       49   6.0 [****
     2.75       41   5.0 [***
     3.00       30   3.7 [**
     3.25       15   1.8 [*
     3.50       17   2.1 [**
     3.75       14   1.7 [*
     4.00       15   1.8 [*
     4.25       12   1.4 [*
     4.50        5   0.6 [*
     4.75        5   0.6 [*
     5.00        3   0.3 [*
     5.25        4   0.4 [*
     5.50        2   0.2 [*
     5.75        1   0.1 [*
     6.00        1   0.1 [*
     6.25        0   0.0 [
     6.50        0   0.0 [
     6.75        0   0.0 [
     7.00        1   0.1 [*
     7.25        0   0.0 [
     7.50        5   0.6 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75       20   5.8 [***
     1.00       27   7.8 [****
     1.25       35  10.1 [******
     1.50       46  13.3 [*******
     1.75       29   8.4 [*****
     2.00       33   9.5 [*****
     2.25       25   7.2 [****
     2.50       27   7.8 [****
     2.75       21   6.1 [****
     3.00       16   4.6 [***
     3.25       10   2.9 [**
     3.50       12   3.4 [**
     3.75        4   1.1 [*
     4.00       11   3.1 [**
     4.25       10   2.9 [**
     4.50        5   1.4 [*
     4.75        3   0.8 [*
     5.00        0   0.0 [
     5.25        3   0.8 [*
     5.50        1   0.2 [*
     5.75        0   0.0 [
     6.00        1   0.2 [*
     6.25        0   0.0 [
     6.50        0   0.0 [
     6.75        0   0.0 [
     7.00        1   0.2 [*
     7.25        0   0.0 [
     7.50        4   1.1 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        3  10.3 [******
     1.00        1   3.4 [**
     1.25        5  17.2 [*********
     1.50        5  17.2 [*********
     1.75        4  13.7 [*******
     2.00        0   0.0 [
     2.25        2   6.8 [****
     2.50        2   6.8 [****
     2.75        3  10.3 [******
     3.00        3  10.3 [******
     3.25        0   0.0 [
     3.50        0   0.0 [
     3.75        1   3.4 [**
     4.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        4  11.4 [******
     1.00        4  11.4 [******
     1.25        4  11.4 [******
     1.50        6  17.1 [*********
     1.75        3   8.5 [*****
     2.00        3   8.5 [*****
     2.25        2   5.7 [***
     2.50        2   5.7 [***
     2.75        1   2.8 [**
     3.00        1   2.8 [**
     3.25        1   2.8 [**
     3.50        0   0.0 [
     3.75        1   2.8 [**
     4.00        0   0.0 [
     4.25        0   0.0 [
     4.50        0   0.0 [
     4.75        0   0.0 [
     5.00        1   2.8 [**
     5.25        0   0.0 [
     5.50        0   0.0 [
     5.75        1   2.8 [**
     6.00        0   0.0 [
     6.25        0   0.0 [
     6.50        0   0.0 [
     6.75        0   0.0 [
     7.00        0   0.0 [
     7.25        0   0.0 [
     7.50        1   2.8 [**
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       1  50.0 [**************************
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1  50.0 [**************************
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1  50.0 [**************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      0   0.0 [
     2.25      0   0.0 [
     2.50      1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      1  50.0 [**************************
     1.00      1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  18   NAME: SPHALERITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      0   0.0 [
     2.25      0   0.0 [
     2.50      0   0.0 [
     2.75      1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  19   NAME: CHALCOPYRITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      1  33.3 [*****************
     1.50      1  33.3 [*****************
     1.75      1  33.3 [*****************
     2.00      0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      1 100.0 [***************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       7  35.0 [******************
     1.00       3  15.0 [********
     1.25       5  25.0 [*************
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       1   5.0 [***
     2.75       1   5.0 [***
     3.00       0   0.0 [
     3.25       1   5.0 [***
     3.50       1   5.0 [***
     3.75       1   5.0 [***
     4.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      12  18.1 [**********
     1.00      10  15.1 [********
     1.25       7  10.6 [******
     1.50      10  15.1 [********
     1.75       6   9.0 [*****
     2.00       6   9.0 [*****
     2.25       6   9.0 [*****
     2.50       2   3.0 [**
     2.75       3   4.5 [***
     3.00       1   1.5 [*
     3.25       1   1.5 [*
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       2   3.0 [**
     4.25       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       7  10.4 [******
     1.00       7  10.4 [******
     1.25      14  20.8 [***********
     1.50       6   8.9 [*****
     1.75       3   4.4 [***
     2.00       4   5.9 [***
     2.25       5   7.4 [****
     2.50       3   4.4 [***
     2.75       4   5.9 [***
     3.00       3   4.4 [***
     3.25       1   1.4 [*
     3.50       3   4.4 [***
     3.75       2   2.9 [**
     4.00       1   1.4 [*
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       1   1.4 [*
     5.00       2   2.9 [**
     5.25       1   1.4 [*
     5.50       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      39  16.9 [**********
     1.00      41  17.8 [**********
     1.25      40  17.3 [**********
     1.50      29  12.6 [********
     1.75      17   7.3 [****
     2.00      18   7.8 [****
     2.25      13   5.6 [***
     2.50      11   4.7 [***
     2.75       6   2.6 [**
     3.00       5   2.1 [**
     3.25       1   0.4 [*
     3.50       1   0.4 [*
     3.75       5   2.1 [**
     4.00       1   0.4 [*
     4.25       2   0.8 [*
     4.50       0   0.0 [
     4.75       1   0.4 [*
     5.00       0   0.0 [
                                                 FRAME NO.    1
                                                 TOTAL NO OF PARTICLES FOR FRAME=  189

                                                 FRAME NO.    2
                                                 TOTAL NO OF PARTICLES FOR FRAME=  615
```

```
                              FILE NO.?39
                              DRIVE NO.?2
SUMMARY OF RESULTS            LABEL: P587-200-RAW-50

LABEL: 85-197-P587-200-UNALTERED(CM)    50X
NUMBER OF FRAMES                 10
NUMBER OF PARTICLES             108
MAGNIFICATION                    50
FIELD WIDTH=             1799.56 um
OFF PARTICLE SPACING=       4.03 um
ON PARTICLE SPACING=        0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE         NAME                  AVE.DIA.              MAX        MAX/MIN     AREA       PERIMETER
                                   MICRONS               MICRONS                uM^2       MICRONS
  0   ALL TYPES             8.71E+00 +-  4.63E+00   1.38E+01   2.53E+00   8.222E+01  3.824E+01
  2   KAOLINITE             8.30E+00 +-  3.20E+00   1.39E+01   2.61E+00   6.954E+01  3.704E+01
  3   ILLITE                7.91E+00 +-  1.38E+00   1.23E+01   2.27E+00   5.660E+01  3.394E+01
  4   QUARTZ                8.46E+00 +-  3.44E+00   1.27E+01   2.27E+00   7.144E+01  3.494E+01
  5   SIDERITE              5.71E+00 +-  0.00E+00   7.91E+00   1.63E+00   2.993E+01  2.153E+01
  7   ANKERITE              1.10E+01 +-  0.00E+00   1.45E+01   1.43E+00   1.230E+02  4.482E+01
 15   APATITE               9.00E+00 +-  4.66E+00   1.36E+01   2.36E+00   7.758E+01  3.603E+01
 24   POLISH                9.88E+00 +-  4.03E+00   1.40E+01   2.10E+00   8.574E+01  3.889E+01
 62   NON-INT               4.43E+01 +-  0.00E+00   6.67E+01   5.84E+00   1.448E+03  2.452E+02
 63   UNKNOWN               8.32E+00 +-  2.67E+00   1.27E+01   2.67E+00   6.622E+01  3.638E+01

PARTICLE COUNT SUMMARY
TYPE         NAME                 NUMBER      #(%)     T.AREA(%)
  0   ALL TYPES                    108      100.00        0.02
  2   KAOLINITE                     55       50.92        0.01
  3   ILLITE                         4        3.70        0.00
  4   QUARTZ                        23       21.29        0.00
  5   SIDERITE                       1        0.92        0.00
  7   ANKERITE                       1        0.92        0.00
 15   APATITE                        2        1.85        0.00
 24   POLISH                         2        1.85        0.00
 62   NON-INT                        1        0.92        0.00
 63   UNKNOWN                       19       17.59        0.00

PRC: HIS


    FILE NO.?39                               THRESHOLDS:  LOWER=  39  UPPER= 255
    LABEL: P587-200-RAW-50
    NO. OF VIDEO SAMPLES    32?

     FRAME NO.    1                                FRAME NO.    6
     TOTAL NO OF PARTICLES FOR FRAME=    7         TOTAL NO OF PARTICLES FOR FRAME=    8

     FRAME NO.    2                                FRAME NO.    7
     TOTAL NO OF PARTICLES FOR FRAME=   26         TOTAL NO OF PARTICLES FOR FRAME=    9

     FRAME NO.    3                                FRAME NO.    8
     TOTAL NO OF PARTICLES FOR FRAME=   11         TOTAL NO OF PARTICLES FOR FRAME=    6

     FRAME NO.    4                                FRAME NO.    9
     TOTAL NO OF PARTICLES FOR FRAME=   17         TOTAL NO OF PARTICLES FOR FRAME=    5

     FRAME NO.    5                                THRESHOLDS:  LOWER=  39  UPPER= 255
     TOTAL NO OF PARTICLES FOR FRAME=   13
                                                   FRAME NO.   10
                                                   TOTAL NO OF PARTICLES FOR FRAME=    6
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      18  16.6 [*********
     7.00      26  24.0 [*************
     8.00      22  20.3 [***********
     9.00       8   7.4 [****
    10.00       7   6.4 [****
    11.00       9   8.3 [*****
    12.00       2   1.8 [*
    13.00       6   5.5 [***
    14.00       2   1.8 [*
    15.00       1   0.9 [*
    16.00       2   1.8 [*
    17.00       0   0.0 [
    18.00       3   2.7 [**
    19.00       1   0.9 [*
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   0.9 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       8  14.5 [********
     7.00      14  25.4 [*************
     8.00      12  21.8 [***********
     9.00       6  10.9 [******
    10.00       5   9.0 [*****
    11.00       5   9.0 [*****
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       2   3.6 [**
    17.00       0   0.0 [
    18.00       2   3.6 [**
    19.00       1   1.8 [*
    20.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       1  25.0 [*************
     8.00       1  25.0 [*************
     9.00       1  25.0 [*************
    10.00       1  25.0 [*************
    11.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       6  26.0 [**************
     7.00       5  21.7 [***********
     8.00       4  17.3 [*********
     9.00       0   0.0 [
    10.00       1   4.3 [***
    11.00       2   8.6 [*****
    12.00       0   0.0 [
    13.00       2   8.6 [*****
    14.00       1   4.3 [***
    15.00       1   4.3 [***
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       1   4.3 [***
    19.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   7   NAME: ANKERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.   %    00---10---20---30---40---50---60---70---80---90---100
     1.00        0    0.0 [
     2.00        0    0.0 [
     3.00        0    0.0 [
     4.00        0    0.0 [
     5.00        0    0.0 [
     6.00        1   50.0 [*************************
     7.00        0    0.0 [
     8.00        0    0.0 [
     9.00        0    0.0 [
    10.00        0    0.0 [
    11.00        0    0.0 [
    12.00        0    0.0 [
    13.00        1   50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.   %    00---10---20---30---40---50---60---70---80---90---100
     1.00        0    0.0 [
     2.00        0    0.0 [
     3.00        0    0.0 [
     4.00        0    0.0 [
     5.00        0    0.0 [
     6.00        0    0.0 [
     7.00        0    0.0 [
     8.00        1   50.0 [*************************
     9.00        0    0.0 [
    10.00        0    0.0 [
    11.00        0    0.0 [
    12.00        0    0.0 [
    13.00        1   50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.   %    00---10---20---30---40---50---60---70---80---90---100
     1.00        0    0.0 [
     2.00        0    0.0 [
     3.00        0    0.0 [
     4.00        0    0.0 [
     5.00        0    0.0 [
     6.00        0    0.0 [
     7.00        0    0.0 [
     8.00        0    0.0 [
     9.00        0    0.0 [
    10.00        0    0.0 [
    11.00        0    0.0 [
    12.00        0    0.0 [
    13.00        0    0.0 [
    14.00        0    0.0 [
    15.00        0    0.0 [
    16.00        0    0.0 [
    17.00        0    0.0 [
    18.00        0    0.0 [
    19.00        0    0.0 [
    20.00        0    0.0 [
    21.00        0    0.0 [
    22.00        0    0.0 [
    23.00        0    0.0 [
    24.00        0    0.0 [
    25.00        0    0.0 [
    26.00        0    0.0 [
    27.00        0    0.0 [
    28.00        0    0.0 [
    29.00        0    0.0 [
    30.00        1  100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       2  10.5 [******
     7.00       6  31.5 [****************
     8.00       4  21.0 [***********
     9.00       1   5.2 [***
    10.00       0   0.0 [
    11.00       2  10.5 [******
    12.00       1   5.2 [***
    13.00       2  10.5 [******
    14.00       1   5.2 [***
    15.00       0   0.0 [

PRC: EDIT PARAMETERS
```

```
SUMMARY OF RESULTS           FILE NO.?41           MAGNIFICATION=               500
                                                   GUARD REGION=              4.000 microns
LABEL: 85-197-P587-200-UNALTERED(CM)    500X       MINIMUM PARTICLE SIZE=     0.500 microns
NUMBER OF FRAMES               12                  MAXIMUM PARTICLE SIZE=     7.500 microns
NUMBER OF PARTICLES           110                  LOW SHAPE FACTOR=          1.000
MAGNIFICATION                 500                  HIGH SHAPE FACTOR=         7.000
FIELD WIDTH=               179.95 um
OFF PARTICLE SPACING=        0.48 um
ON PARTICLE SPACING=         0.04 um                  THRESHOLDS:  LOWER=  76  UPPER= 255
FIELD AREA=             3.23E+04 um^2
TYPE          NAME                 AVE.DIA.             MAX        MAX/MIN     AREA       PERIMETER
                                   MICRONS             MICRONS                 uM^2       MICRONS
  0  ALL TYPES            1.65E+00 +-  1.12E+00    2.47E+00    2.35E+00  3.305E+00  6.519E+00
  2  KAOLINITE            2.27E+00 +-  1.35E+00    3.36E+00    2.25E+00  5.691E+00  8.815E+00
  3  ILLITE               1.21E+00 +-  2.85E-01    1.75E+00    1.94E+00  1.287E+00  4.460E+00
  4  QUARTZ               1.56E+00 +-  1.07E+00    2.23E+00    2.01E+00  2.909E+00  5.881E+00
  5  SIDERITE             1.95E+00 +-  5.28E-01    2.21E+00    1.24E+00  3.120E+00  6.372E+00
 23  ZIRCON               9.22E-01 +-  6.21E-02    1.27E+00    1.81E+00  7.179E-01  3.383E+00
 24  POLISH               1.32E+00 +-  7.98E-01    2.17E+00    2.72E+00  1.982E+00  5.629E+00
 63  UNKNOWN              1.31E+00 +-  8.79E-01    2.06E+00    2.75E+00  2.142E+00  5.531E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                      110       100.00       0.09
  2  KAOLINITE                       33        30.00       0.04
  3  ILLITE                           6         5.45       0.00
  4  QUARTZ                          24        21.81       0.01
  5  SIDERITE                         2         1.81       0.00
 23  ZIRCON                           2         1.81       0.00
 24  POLISH                          10         9.09       0.00
 63  UNKNOWN                         33        30.00       0.01

PRC: HIO\OS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25      0   0.0 [
      0.50      0   0.0 [
      0.75     17  15.4 [********
      1.00     19  17.2 [*********        85-197 P587 -200 mesh cold mount,at 500x
      1.25     19  17.2 [*********
      1.50      8   7.2 [****             Lower      Upper      Frame     Total
      1.75     13  11.8 [******           Threshold  Threshold  Number    Particles
      2.00      7   6.3 [****
      2.25      3   2.7 [**                      76        255         1          2
      2.50      5   4.5 [***                     76        255         2          8
      2.75      2   1.8 [*                       76        255         3         14
      3.00      4   3.6 [**                      76        255         4         10
      3.25      3   2.7 [**                      76        255         5          6
      3.50      1   0.9 [*                       76        255         6          7
      3.75      2   1.8 [*                       76        255         7          6
      4.00      1   0.9 [*                       76        255         8          3
      4.25      0   0.0 [                        76        255         9          2
      4.50      0   0.0 [                        76        255        10         15
      4.75      2   1.8 [*                       76        255        11         27
      5.00      0   0.0 [                        76        255        12         10
      5.25      2   1.8 [*
      5.50      2   1.8 [*                                  Average:          9.2
      5.75      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2   6.0 [****
     1.00       2   6.0 [****
     1.25       6  18.1 [**********
     1.50       1   3.0 [**
     1.75       4  12.1 [*******
     2.00       4  12.1 [*******
     2.25       1   3.0 [**
     2.50       1   3.0 [**
     2.75       2   6.0 [****
     3.00       2   6.0 [****
     3.25       1   3.0 [**
     3.50       1   3.0 [**
     3.75       1   3.0 [**
     4.00       1   3.0 [**
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       1   3.0 [**
     5.00       0   0.0 [
     5.25       1   3.0 [**
     5.50       2   6.0 [****
     5.75       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1  16.6 [*********
     1.25       3  50.0 [**************************
     1.50       1  16.6 [*********
     1.75       1  16.6 [*********
     2.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       3  12.5 [*******
     1.00       5  20.8 [***********
     1.25       5  20.8 [***********
     1.50       2   8.3 [*****
     1.75       3  12.5 [*******
     2.00       1   4.1 [***
     2.25       0   0.0 [
     2.50       2   8.3 [*****
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       1   4.1 [***
     3.50       0   0.0 [
     3.75       1   4.1 [***
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       1   4.1 [***
     5.50       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       1  50.0 [**************************
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       2 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       3  30.0 [****************
     1.00       2  20.0 [***********
     1.25       1  10.0 [******
     1.50       1  10.0 [******
     1.75       1  10.0 [******
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       1  10.0 [******
     2.75       0   0.0 [
     3.00       1  10.0 [******

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       9  27.2 [**************
     1.00       7  21.2 [***********
     1.25       4  12.1 [*******
     1.50       3   9.0 [*****
     1.75       3   9.0 [*****
     2.00       2   6.0 [****
     2.25       2   6.0 [****
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1   3.0 [**
     3.25       1   3.0 [**
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       1   3.0 [**
     5.00       0   0.0 [
SUMMARY OF RESULTS

                                                LABEL: 85-197-P587-400-CM 50XDB
LABEL: 85-197-P587-400-CM 50X                   MAGNIFICATION=               50
NUMBER OF FRAMES              4                 GUARD REGION=             15.000 microns
NUMBER OF PARTICLES         123                 MINIMUM PARTICLE SIZE=     5.000 microns
MAGNIFICATION                50                 MAXIMUM PARTICLE SIZE=    30.000 microns
FIELD WIDTH=            1799.56 um              LOW SHAPE FACTOR=          1.000
OFF PARTICLE SPACING=      4.83 um              HIGH SHAPE FACTOR=         7.000
ON PARTICLE SPACING=       0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE          NAME                 AVE.DIA.                  MAX        MAX/MIN     AREA       PERIMETER
                                   MICRONS                 MICRONS                  uM^2       MICRONS
  0  ALL TYPES               7.75E+00 +-  3.10E+00    1.17E+01    2.36E+00   6.094E+01  3.290E+01
  1  PYRITE                  5.27E+00 +-  0.00E+00    7.47E+00    1.69E+00   2.520E+01  2.065E+01
  2  KAOLINITE               7.86E+00 +-  3.31E+00    1.10E+01    2.05E+00   6.241E+01  3.233E+01
  3  ILLITE                  7.76E+00 +-  2.74E+00    1.25E+01    2.63E+00   5.791E+01  3.442E+01
  4  QUARTZ                  8.65E+00 +-  3.74E+00    1.35E+01    2.47E+00   7.741E+01  3.602E+01
 15  APATITE                 6.81E+00 +-  2.17E+00    8.56E+00    1.79E+00   4.171E+01  2.592E+01
 24  POLISH                  6.84E+00 +-  1.83E+00    1.17E+01    3.04E+00   4.620E+01  3.124E+01
 63  UNKNOWN                 6.94E+00 +-  2.05E+00    1.02E+01    2.29E+00   4.590E+01  3.128E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                     123     100.00        0.05           FILE NO.?17
  1  PYRITE                          1       0.81        0.00           DRIVE NO.?2
  2  KAOLINITE                      48      39.02        0.02           LABEL: P587-400CMX50
  3  ILLITE                          6       4.87        0.00
  4  QUARTZ                         32      26.01        0.01
 15  APATITE                         2       1.62        0.00
 24  POLISH                         19      15.44        0.00
 63  UNKNOWN                        15      12.19        0.00


PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00      0   0.0 [
     2.00      0   0.0 [
     3.00      0   0.0 [
     4.00      0   0.0 [
     5.00      0   0.0 [                               FRAME NO.    1
     6.00     34  27.6 [**************                 TOTAL NO OF PARTICLES FOR FRAME=   58
     7.00     30  24.3 [*************
     8.00     28  22.7 [************                   FRAME NO.    2
     9.00      6   4.8 [***                            TOTAL NO OF PARTICLES FOR FRAME=   31
    10.00      6   4.8 [***
    11.00      3   2.4 [**                             FRAME NO.    3
    12.00      4   3.2 [**                             TOTAL NO OF PARTICLES FOR FRAME=   27
    13.00      2   1.6 [*
    14.00      1   0.8 [*                              FRAME NO.    4
    15.00      3   2.4 [**                             TOTAL NO OF PARTICLES FOR FRAME=    7
    16.00      3   2.4 [**
    17.00      0   0.0 [
    18.00      1   0.8 [*
    19.00      1   0.8 [*
    20.00      0   0.0 [                             THRESHOLDS:  LOWER=  90  UPPER= 255
    21.00      0   0.0 [
    22.00      1   0.8 [*
    23.00      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00      0   0.0 [
     2.00      0   0.0 [
     3.00      0   0.0 [
     4.00      0   0.0 [
     5.00      0   0.0 [
     6.00      7  14.5 [********
     7.00     18  37.5 [*******************
     8.00     13  27.0 [**************
     9.00      1   2.0 [**
    10.00      2   4.1 [***
    11.00      2   4.1 [***
    12.00      1   2.0 [**
    13.00      0   0.0 [
    14.00      0   0.0 [
    15.00      1   2.0 [**
    16.00      1   2.0 [**
    17.00      0   0.0 [
    18.00      1   2.0 [**
    19.00      0   0.0 [
    20.00      0   0.0 [
    21.00      0   0.0 [
    22.00      1   2.0 [**
    23.00      0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00      0   0.0 [
     2.00      0   0.0 [
     3.00      0   0.0 [
     4.00      0   0.0 [
     5.00      0   0.0 [
     6.00      2  33.3 [*****************
     7.00      0   0.0 [
     8.00      2  33.3 [*****************
     9.00      0   0.0 [
    10.00      1  16.6 [*********
    11.00      0   0.0 [
    12.00      0   0.0 [
    13.00      1  16.6 [*********
    14.00      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       9  28.1 [***************
     7.00       5  15.6 [********
     8.00       6  18.7 [**********
     9.00       3   9.3 [*****
    10.00       0   0.0 [
    11.00       1   3.1 [**
    12.00       2   6.2 [****
    13.00       0   0.0 [
    14.00       1   3.1 [**
    15.00       2   6.2 [****
    16.00       2   6.2 [****
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1   3.1 [**
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  50.0 [**************************
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       8  42.1 [**********************
     7.00       4  21.0 [***********
     8.00       4  21.0 [***********
     9.00       0   0.0 [
    10.00       2  10.5 [******
    11.00       0   0.0 [
    12.00       1   5.2 [***
    13.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       6  40.0 [*********************
     7.00       3  20.0 [***********
     8.00       3  20.0 [***********
     9.00       1   6.6 [****
    10.00       1   6.6 [****
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       1   6.6 [****
    14.00       0   0.0 [
                                                     LABEL: 85-197-P587-400-CM 500X
SUMMARY OF RESULTS                                   MAGNIFICATION=                500
                                                     GUARD REGION=               4.000 microns
LABEL: 85-197-P587-400-CM 500X                       MINIMUM PARTICLE SIZE=      0.500 microns
NUMBER OF FRAMES                  3                  MAXIMUM PARTICLE SIZE=      7.500 microns
NUMBER OF PARTICLES             105                  LOW SHAPE FACTOR=           1.000
MAGNIFICATION                   500                  HIGH SHAPE FACTOR=          7.000
FIELD WIDTH=                179.95 um
OFF PARTICLE SPACING=         0.48 um                   THRESHOLDS:  LOWER=  79  UPPER= 255
ON PARTICLE SPACING=          0.04 um
FIELD AREA=               3.23E+04 um^2
TYPE          NAME                  AVE.DIA.                 MAX        MAX/MIN      AREA       PERIMETER
                                    MICRONS                MICRONS                   uM^2       MICRONS
  0  ALL TYPES              1.33E+00 +-  8.63E-01      1.91E+00     2.15E+00   2.093E+00   5.242E+00
  2  KAOLINITE              2.16E+00 +-  1.13E+00      3.12E+00     1.92E+00   4.834E+00   8.112E+00
  3  ILLITE                 7.25E-01 +-  2.79E-01      9.88E-01     2.25E+00   4.760E-01   2.636E+00
  4  QUARTZ                 1.45E+00 +-  1.01E+00      1.84E+00     1.73E+00   2.443E+00   5.281E+00
 14  RUTILE                 8.78E-01 +-  0.00E+00      1.05E+00     1.41E+00   6.604E-01   3.076E+00
 15  APATITE                1.71E+00 +-  0.00E+00      1.93E+00     1.25E+00   2.317E+00   5.625E+00
 22  ILLITE + Ti            1.01E+00 +-  0.00E+00      2.24E+00     3.92E+00   9.028E-01   4.921E+00
 23  ZIRCON                 7.47E-01 +-  0.00E+00      1.01E+00     1.91E+00   4.596E-01   2.724E+00
 24  POLISH                 1.03E+00 +-  5.17E-01      1.54E+00     2.41E+00   1.166E+00   4.362E+00
 62  NON-INT                1.03E+00 +-  7.21E-01      1.54E+00     2.44E+00   1.335E+00   4.243E+00
 63  UNKNOWN                1.24E+00 +-  6.67E-01      1.77E+00     2.11E+00   1.648E+00   5.013E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER      #(%)      T.AREA(%)
  0  ALL TYPES                       105     100.00         0.22          FILE NO.?19
  2  KAOLINITE                        18      17.14         0.08          DRIVE NO.?2
  3  ILLITE                            2       1.90         0.00          LABEL: P587-400CM-500X
  4  QUARTZ                           11      10.47         0.02
 14  RUTILE                            1       0.95         0.00
 15  APATITE                           1       0.95         0.00
 22  ILLITE + Ti                       1       0.95         0.00
 23  ZIRCON                            1       0.95         0.00
 24  POLISH                           19      18.09         0.02
 62  NON-INT                          18      17.14         0.02
 63  UNKNOWN                          33      31.42         0.05

PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75     33  31.4 [****************
     1.00     16  15.2 [********
     1.25     17  16.1 [*********                     FRAME NO.    1
     1.50      9   8.5 [*****                         TOTAL NO OF PARTICLES FOR FRAME=   16
     1.75      6   5.7 [***
     2.00      4   3.8 [**                            FRAME NO.    2
     2.25      6   5.7 [***                           TOTAL NO OF PARTICLES FOR FRAME=   35
     2.50      1   0.9 [*
     2.75      4   3.8 [**                            FRAME NO.    3
     3.00      5   4.7 [***                           TOTAL NO OF PARTICLES FOR FRAME=   54
     3.25      0   0.0 [
     3.50      0   0.0 [
     3.75      1   0.9 [*
     4.00      1   0.9 [*
     4.25      1   0.9 [*
     4.50      0   0.0 [
     4.75      1   0.9 [*
     5.00      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2  11.1 [******
     1.00       0   0.0 [
     1.25       2  11.1 [******
     1.50       2  11.1 [******
     1.75       3  16.6 [*********
     2.00       1   5.5 [***
     2.25       1   5.5 [***
     2.50       0   0.0 [
     2.75       2  11.1 [******
     3.00       2  11.1 [******
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       1   5.5 [***
     4.00       0   0.0 [
     4.25       1   5.5 [***
     4.50       0   0.0 [
     4.75       1   5.5 [***
     5.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       1  50.0 [*************************
     1.00       1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2  18.1 [**********
     1.00       3  27.2 [**************
     1.25       2  18.1 [**********
     1.50       0   0.0 [
     1.75       1   9.0 [*****
     2.00       0   0.0 [
     2.25       2  18.1 [**********
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       1   9.0 [*****
     4.25       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)   NO.  %   00---19---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      9  47.3 [************************
     1.00      2  10.5 [******
     1.25      3  15.7 [********
     1.50      2  10.5 [******
     1.75      1   5.2 [***
     2.00      0   0.0 [
     2.25      2  10.5 [******
     2.50      0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      9  50.0 [*************************
     1.00      4  22.2 [************
     1.25      1   5.5 [***
     1.50      1   5.5 [***
     1.75      0   0.0 [
     2.00      1   5.5 [***
     2.25      0   0.0 [
     2.50      0   0.0 [
     2.75      1   5.5 [***
     3.00      1   5.5 [***
     3.25      0   0.0 [
.AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
 BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       9  27.2 [**************
      1.00       5  15.1 [********
      1.25       8  24.2 [*************
      1.50       4  12.1 [*******
      1.75       0   0.0 [
      2.00       2   6.0 [****
      2.25       1   3.0 [**
      2.50       1   3.0 [**
      2.75       1   3.0 [**
      3.00       2   6.0 [****
      3.25       0   0.0 [
```

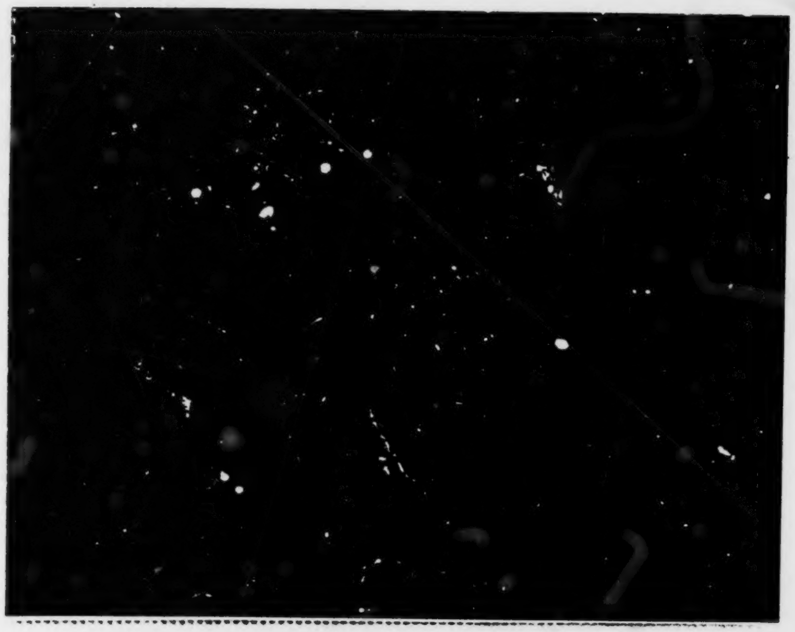
PHOTOMICROGRAPHS: PLATE #3
Eastern Canadian Bituminous Coal (P743)
Crushed Coal -20 mesh

Eastern Canadian Bituminous

Mounted in leucite as polished pellet, coated with carbon.

1.	0217-01	35X, BEI. "Shadows" of coal grains in resin mount. Note microfractures filled with minerals. Many grains are mineral free.
2.	0217-02	150X, BEI. Enlarged view of #1. microfractures.
3.	0217-04	150X, BEI. Enlarged #1.
4.	0217-03	150X, BEI. Enlarged #1. Note the bedding textures and dessication cracks.
5.	0217-05	500X, BEI. Enlarged #2. Pyrite shows radiating texture suggesting "immature" crystals or marcasite. Aluminum polish (X) accounts for some infillings.
6.	0217-06	500X, BEI. Enlarged #4. Grains show "plucking" in kaolinite rich grains.
7.	0217-07	500X, BEI. Enlarged #3. Note pyrite in bedding plane. Mottled texture is due to beam heating of the resin mount.
8.	0217-08	500X BEI. Enlarged from #1. Pyrite fills microfractures, but the other mineral filling the maceral breccia is not identified. Two EDX spectra confirm an Al-Si-Fe chemistry with large background, indicating an organic or amorphous contribution. This may be the mineral Staurolite $(Fe_2Al_9O_7(SiO_4)_4$ which has been reported, associated with carbonaceous matter and coals.

1



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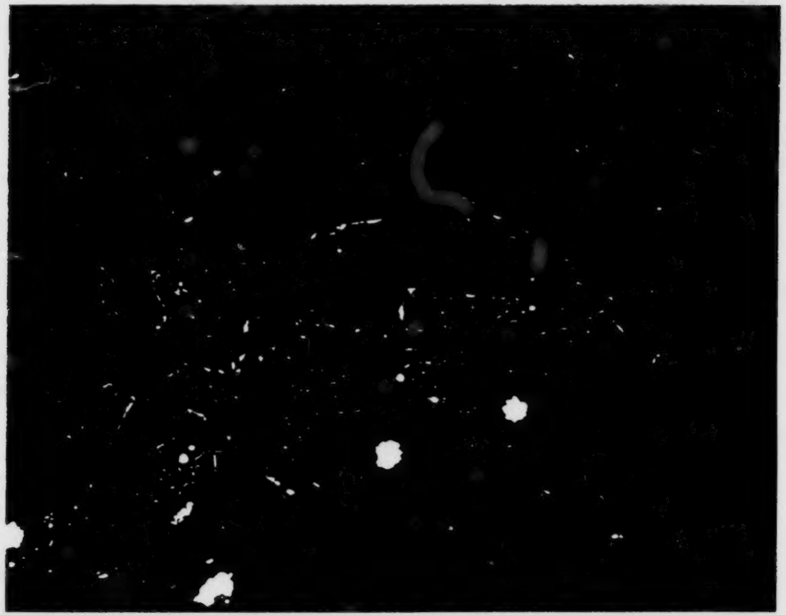

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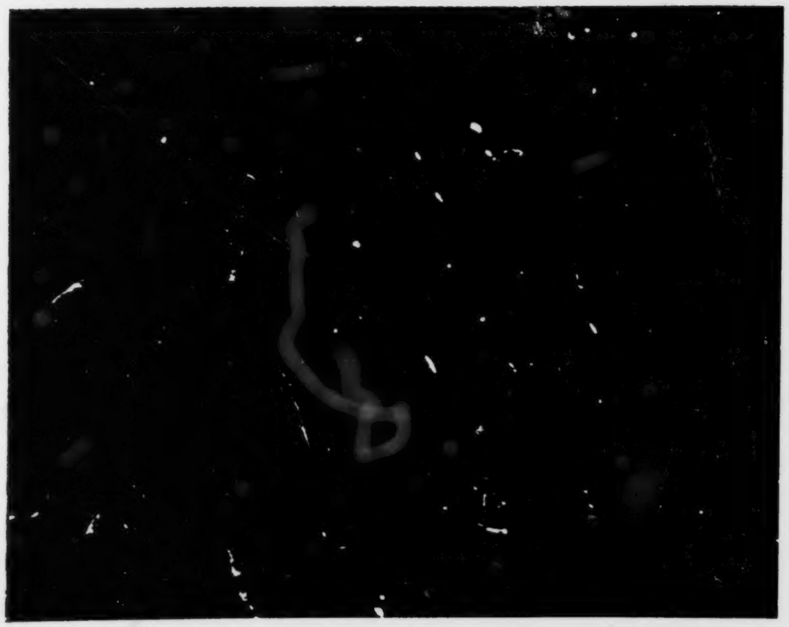

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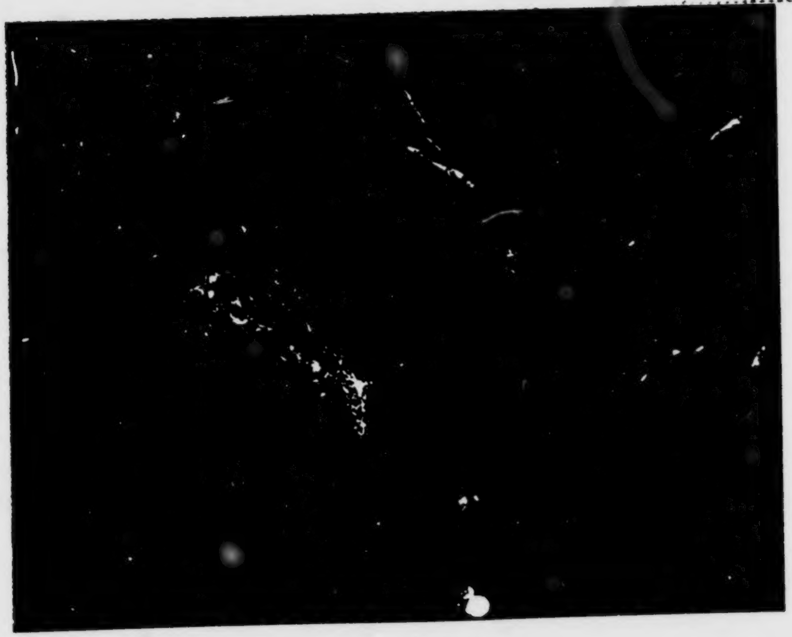
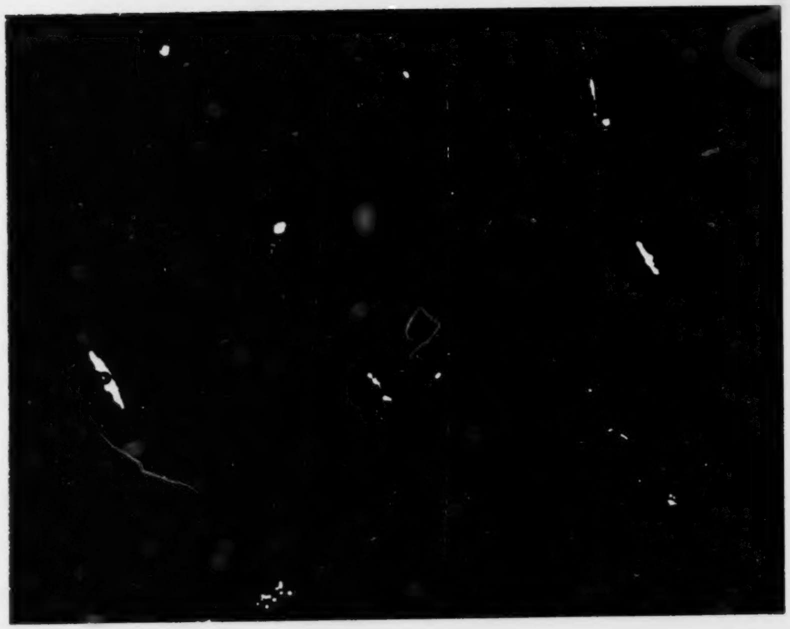


5

6



7

8

EDX SPECTRA: SET #3
20 Kv, Spot Mode
Crushed Coal -20 mesh
Eastern Bituminous

1. unknown mineral: high Bremsstrahlung suggests presence of a morphous organic material (low atomic number). Otherwise, this could be a high iron clay or the mineral staurolite, $(Fe_2Al_9O_7(SiO_4)_4$.

2. Pyrrhotite (?) or an iron sulphate. Alternatively the geometry effects may have distorted a pyrite spectrum.

3. Unknown mineral: This spectrum does not match any previously recognized mineral in Eastern Canadian coals. It may be a composite from spectra #1 and #2 plus polish (Al) or the mineral staurolite.

4. This is likely polish (Al_2O_3) with traces of chlorine and sulphur from the coal matrix.

5. Kaolinite. But note sulphur as a spurious peak, likely from the coal.

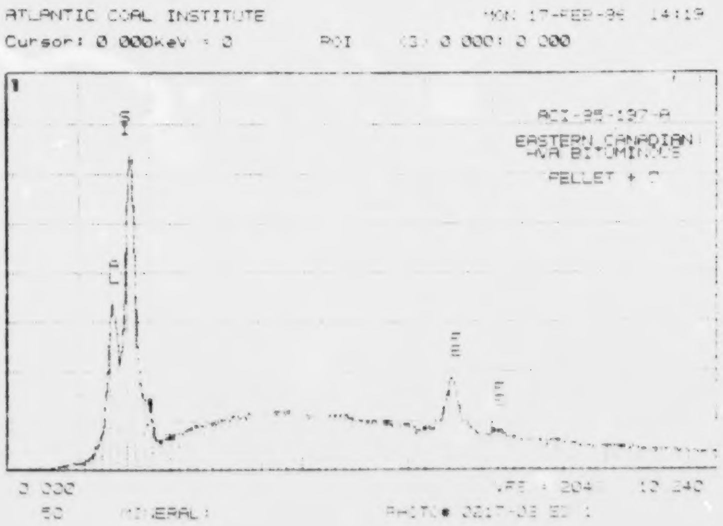
6. Illite: with trace S from the coal? The potassium content is relatively high.

7. Aluminium polish with Al, Cl, Fe possibly from the coal.

8. Coal maceral: the large chlorine peak and sulphur explain the spurious peaks in #7.

9. Coal maceral: Note high S, Cl and Ca.

10. Coal maceral: Note high Cl, S.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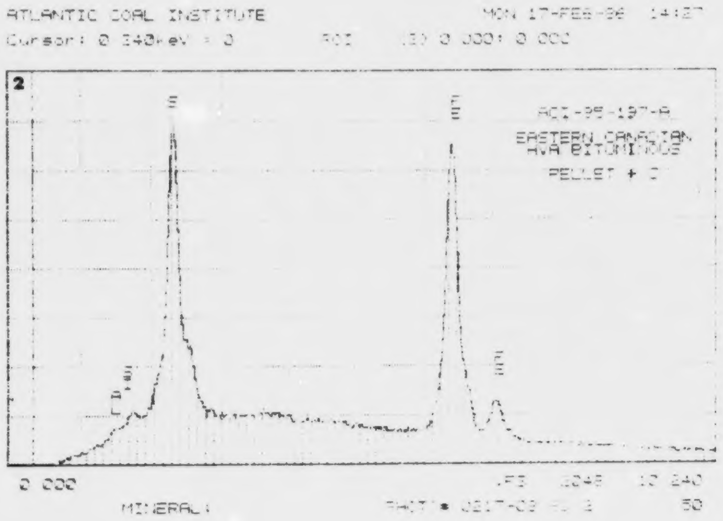
MON 17-FEB-86 14:19
Cursor: 0 000keV = 0
ROI (3) 0 000: 0 000
1
ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C
S I
A L
F E
F E
0 000
VFS = 2048
10 240
50
MINERAL:
PHOTO# 0217-03 ED 1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MON 17-FEB-86 14:27
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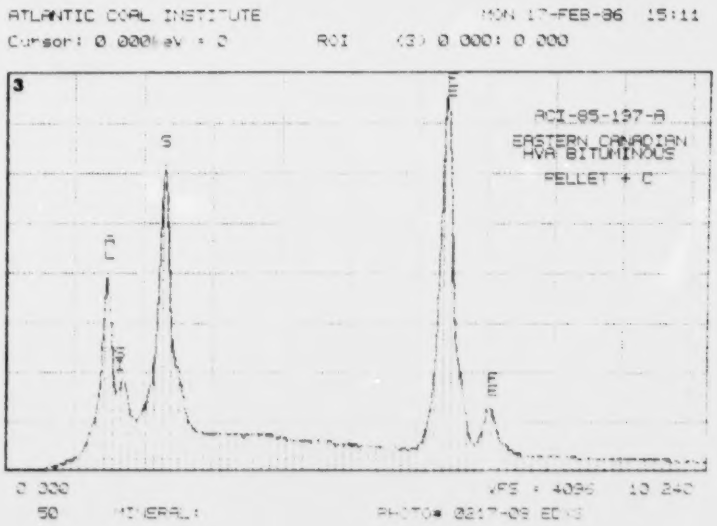
ROI (3) 0 000: 0 000
2
ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C
S
F E
A L
S I
F E
0 000
VFS = 2048
10 240
MINERAL:
PHOTO# 0217-03 ED 2
50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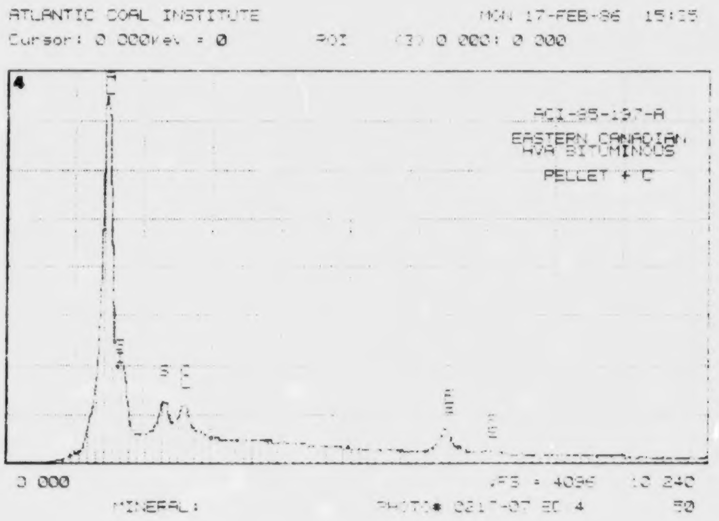
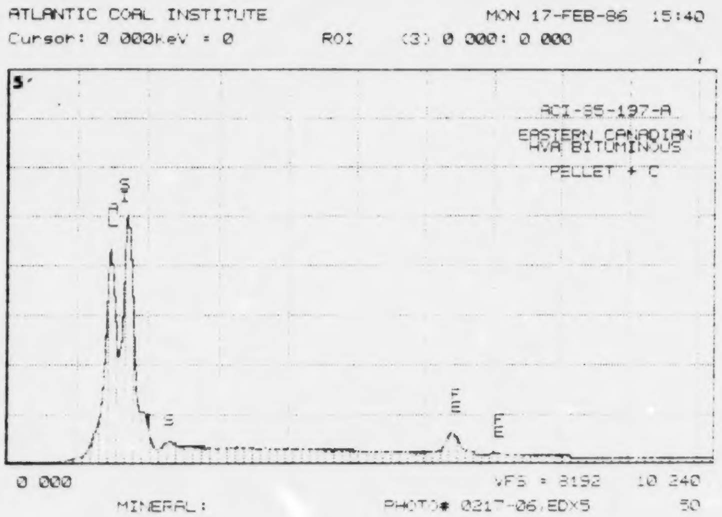
MON 17-FEB-86 15:11
Cursor: 0 000keV = 0
ROI (3) 0 000: 0 000
3
ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C
F E
S
A L
S I
F E
0 000
VFS = 4096
10 240
50
MINERAL:
PHOTO# 0217-09 ED 3

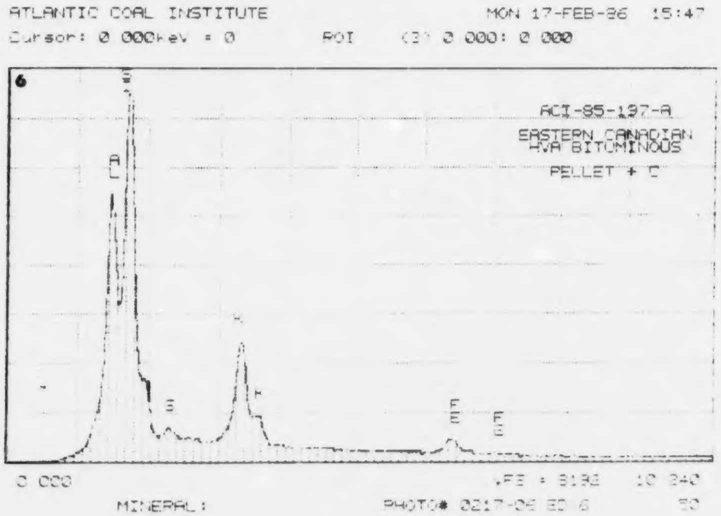

ATLANTIC COAL INSTITUTE
MON 17-FEB-86 15:25
Cursor: 0 000keV = 0
ROI (3) 0 000: 0 000
4
ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C
S
C L
F E
F E
0 000
VFS = 4096
10 240
MINERAL:
PHOTO# 0217-07 ED 4
50



ATLANTIC COAL INSTITUTE MON 17-FEB-86 15:40
Cursor: 0 000keV = 0 ROI (3) 0 000: 0 000

ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C

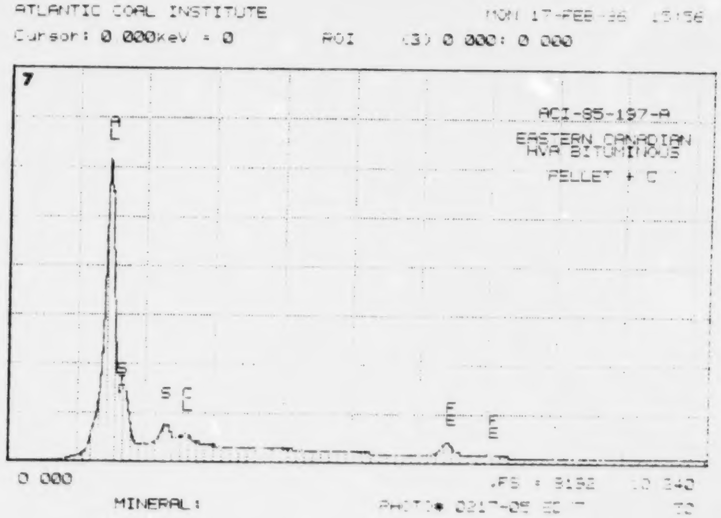
0 000 VFS = 8192 10 240
MINERAL: PHOTO# 0217-06,EDX5 50



ATLANTIC COAL INSTITUTE MON 17-FEB-86 15:47
Cursor: 0 000keV = 0 ROI (3) 0 000: 0 000

ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C

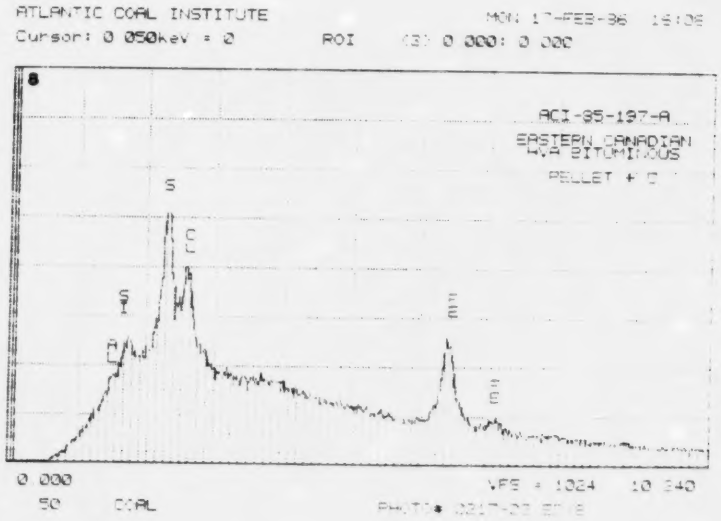
0 000 VFS = 8192 10 240
MINERAL: PHOTO# 0217-06 ED 6 50



ATLANTIC COAL INSTITUTE MON 17-FEB-86 15:56
Cursor: 0 000keV = 0 ROI (3) 0 000: 0 000

ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C

0 000 VFS = 8192 10 240
MINERAL: PHOTO# 0217-05 ED 7 50



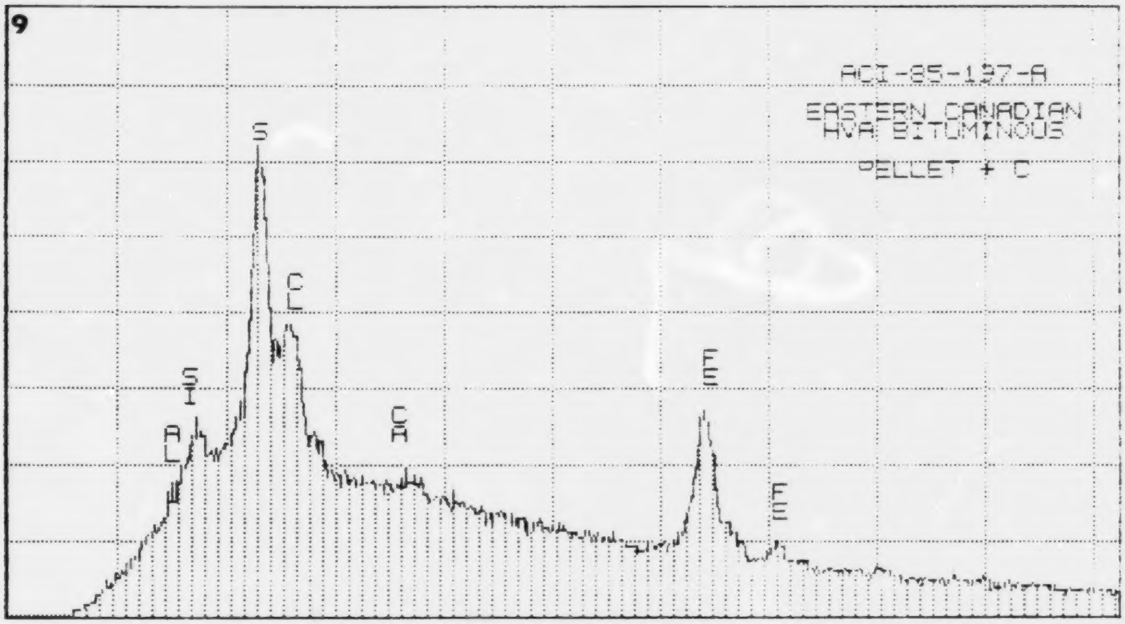
ATLANTIC COAL INSTITUTE MON 17-FEB-86 16:06
Cursor: 0 050keV = 0 ROI (3) 0 000: 0 000

ACI-85-197-A
EASTERN CANADIAN
HVA BITUMINOUS
PELLET + C

0.000 VFS = 1024 10 240
50 COAL PHOTO# 0217-0? ED 8

ATLANTIC COAL INSTITUTE MON 17-FEB-86 16:11

Cursor: 0.000keV = 0

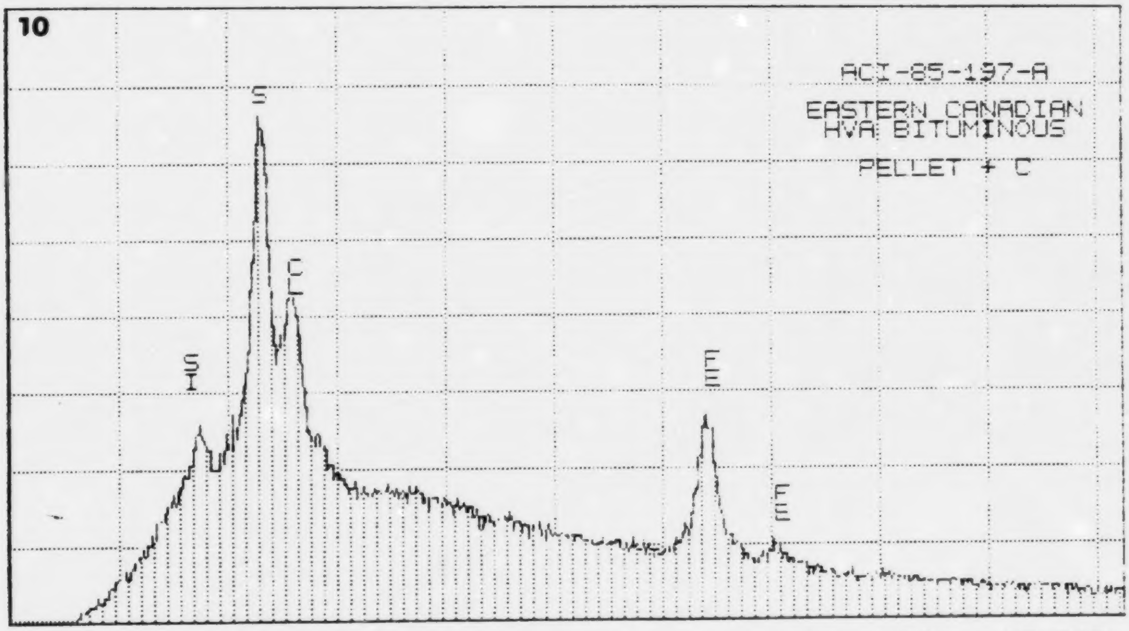


0.000 VFS = 1024 10 240

MINERAL: PHOTO# 0217-04.EDX9 50

ATLANTIC COAL INSTITUTE MON 17-FEB-86 16:20

Cursor: 0.000keV = 0



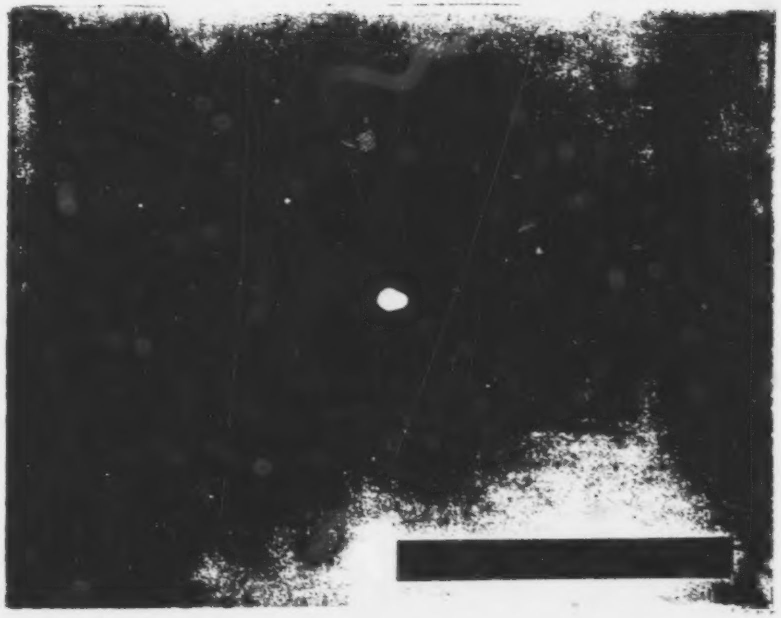
0.000 VFS = 1024 10 240

50 COAL PHOTO# 0217-03.EDX10

EASTERN COAL: P743 Plate #4
-400 MESH (micronized)

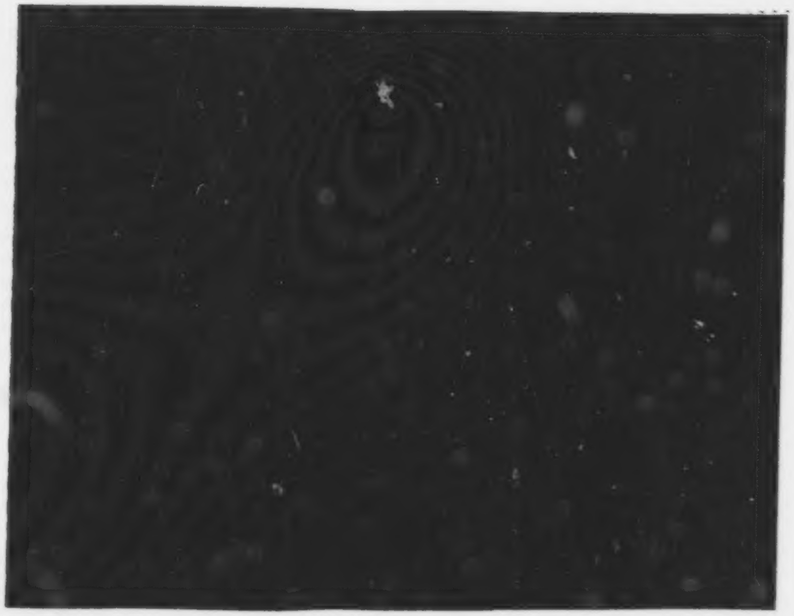
1.	0712-02	500X BEI. Coal in leucite pellet polished, carbon coated.
2.	0712-01	500X BEI, 20 Kv. Same image at increased brightness. Note SEM "burn" pattern.
3.	0710-07	35X SEI, 20 Kv. Powder mounted on Au coated glass slide.
4.	0710-08	35X BEI, 20 Kv. Powder mounted on Au coated glass slide.
5.	0710-09	100X SEI, 20 Kv. As above. Note bright grains due to charging.
6.	0710-11	100X BEI, 20 Kv. As above. Note lack of bright grains (high Z).
7.	0710-10	1000X SEI, 20 Kv. As above. Powder on Au coated glass slide. Note halo effect due to beam charging.
8.	0710-12	1000X BEI, 20 Kv. As above. Rare grey grains are minerals.

1



2

3

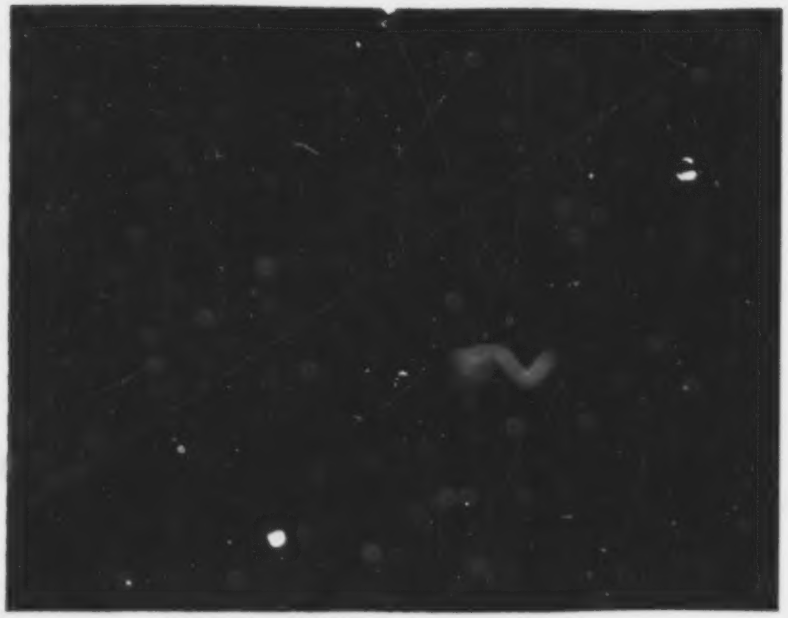


4

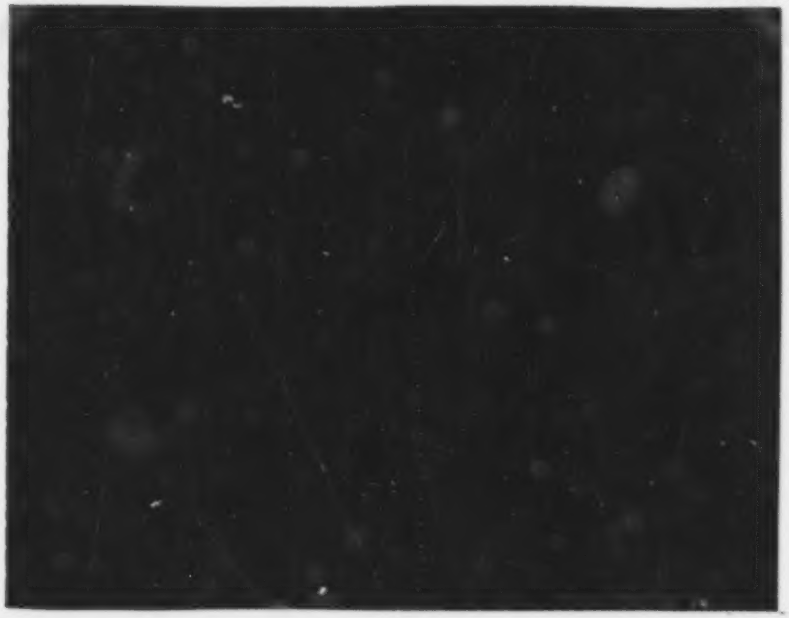
5

6

7



8



EASTERN COAL: P743 Plate #5
-400 mesh coal (micronized)

1. 0710-02 100X, SEI,20 Kv. Coal particles dispersed on nuclepore filter using ultrasonics, propanol. Droplet was evaporated on filter then mounted on carbon stub using Apeizon grease. Carbon coated.

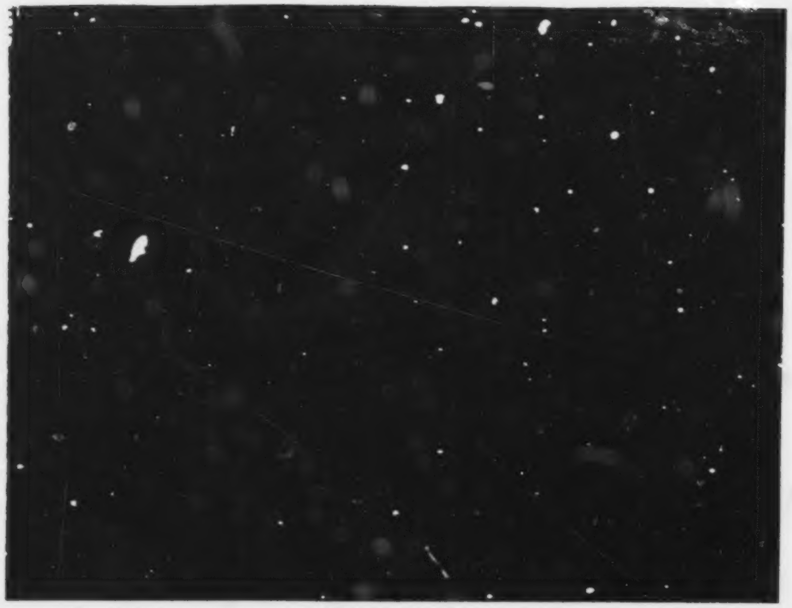
2. 0710-03 100X BEI, 20 Kv. Note absence of bright grains (high Z minerals).

3. 0710-04 1000X SEI. The majority of particles are submicron size. The largest grains are less than 5 microns in diameter.

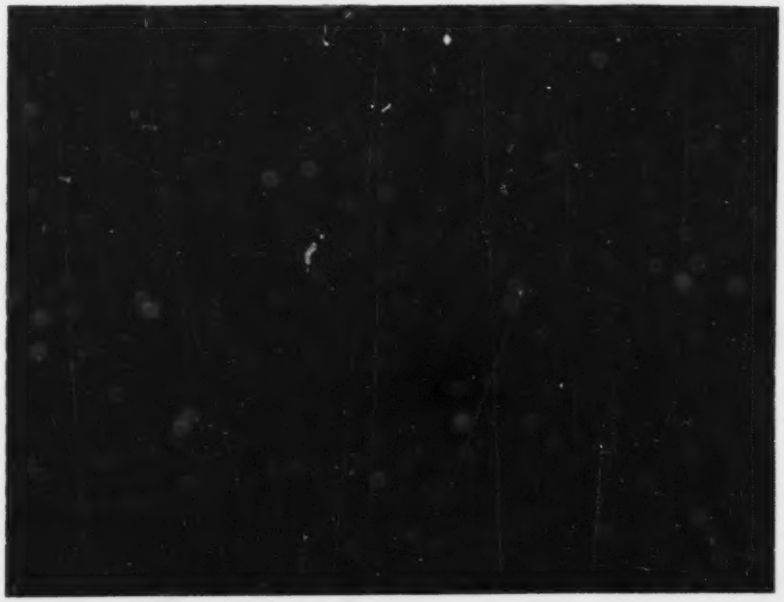
4. 0710-05 1000X BEI. The resolution in BEI mode is not sufficient to define the submicron particles. The brighter grains are minerals. Note, however, that the majority of grains have very low contrast. For particles <0.5 microns, the BEI signal drops linearly with particle diameter.

5. 0710-01 5000X SEI. Particles evaporated on nuclepore filter using propanol and ultrasonic dispersion. Note that the majority of particles are submicron. Therefore, these samples are difficult to characterize in backscatter electron mode.

6. 0710-06 5000X BEI. At such high magnification, there is virtually no resolution in BEI mode. Thus these samples are not appropriate for particulate analysis by BEI. (Same field as photo 5, #0710-01).



1

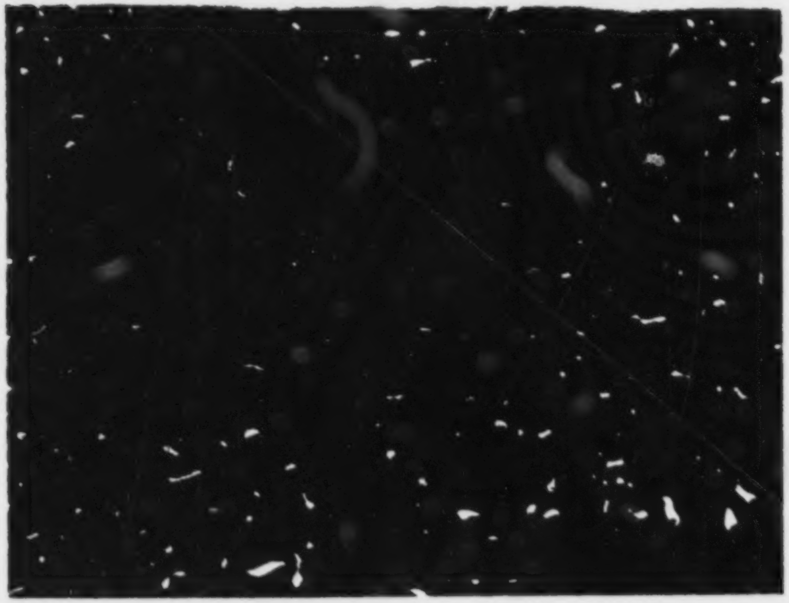


2

3

4

5



6

```
PARAMETER SETUP

LABEL: 85-197-P743-20-UNALTERED  50X
MAGNIFICATION=                    50
GUARD REGION=                 15.000 microns
MINIMUM PARTICLE SIZE=         5.000 microns
MAXIMUM PARTICLE SIZE=        30.000 microns
LOW SHAPE FACTOR=              1.000
HIGH SHAPE FACTOR=             7.000


PRC: REPORT    FILE NO.?33
```

```
THRESHOLDS:  LOWER=  39  UPPER= 255

FRAME NO.     1
TOTAL NO OF PARTICLES FOR FRAME=  153

THRESHOLDS:  LOWER=  39  UPPER= 255

FRAME NO.     2
TOTAL NO OF PARTICLES FOR FRAME=  234

THRESHOLDS:  LOWER=  38  UPPER= 255

FRAME NO.     3
TOTAL NO OF PARTICLES FOR FRAME=  303
```

```
SUMMARY OF RESULTS

LABEL: 85-197-P743-20-UNALTERED  50X
NUMBER OF FRAMES              3
NUMBER OF PARTICLES         690
MAGNIFICATION                50
FIELD WIDTH=           1799.56 um
OFF PARTICLE SPACING=     4.83 um
ON PARTICLE SPACING=      0.43 um
FIELD AREA=          3.23E+06 um^2
TYPE          NAME               AVE.DIA.               MAX        MAX/MIN     AREA       PERIMETER
                                  MICRONS              MICRONS                  uM^2       MICRONS
  0  ALL TYPES            8.84E+00 +-  4.91E+00   1.49E+01   3.15E+00  8.820E+01  4.065E+01
  1  PYRITE               8.83E+00 +-  3.65E+00   1.31E+01   2.24E+00  7.809E+01  3.592E+01
  2  KAOLINITE            7.88E+00 +-  2.76E+00   1.29E+01   2.79E+00  6.263E+01  3.495E+01
  3  ILLITE               8.36E+00 +-  3.84E+00   1.60E+01   3.49E+00  7.570E+01  4.023E+01
  4  QUARTZ               9.57E+00 +-  4.54E+00   1.34E+01   2.12E+00  9.165E+01  3.645E+01
 11  GYPSUM               5.27E+00 +-  0.00E+00   6.15E+00   1.27E+00  2.404E+01  1.977E+01
 13  HALITE               1.05E+01 +-  1.24E+00   1.56E+01   2.07E+00  9.916E+01  4.218E+01
 20  ORGANIC SULPHUR      1.12E+01 +-  4.95E+00   1.46E+01   1.77E+00  1.198E+02  4.376E+01
 21  FeS (?)              1.24E+01 +-  4.54E+00   2.05E+01   3.17E+00  1.519E+02  5.583E+01
 22  ILLITE + Ti          1.08E+01 +-  8.63E+00   2.28E+01   2.99E+00  1.456E+02  6.229E+01
 23  ZIRCON               6.59E+00 +-  0.00E+00   8.34E+00   1.58E+00  3.872E+01  2.460E+01
 24  POLISH               7.87E+00 +-  2.33E+00   1.43E+01   3.64E+00  6.110E+01  3.920E+01
 62  NON-INT              9.33E+00 +-  3.86E+00   1.52E+01   3.24E+00  8.681E+01  4.352E+01
 63  UNKNOWN              8.79E+00 +-  7.05E+00   1.65E+01   3.97E+00  1.087E+02  4.435E+01

PARTICLE COUNT SUMMARY
TYPE          NAME               NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                     690     100.00        0.62
  1  PYRITE                        195      28.26        0.15
  2  KAOLINITE                      38       5.50        0.02
  3  ILLITE                         47       6.81        0.03
  4  QUARTZ                         18       2.60        0.01
 11  GYPSUM                          1       0.14        0.00
 13  HALITE                          2       0.28        0.00
 20  ORGANIC SULPHUR                 5       0.72        0.00
 21  FeS (?)                        17       2.46        0.02
 22  ILLITE + Ti                     4       0.57        0.00
 23  ZIRCON                          1       0.14        0.00
 24  POLISH                         69      10.00        0.04
 62  NON-INT                        94      13.62        0.08
 63  UNKNOWN                       199      28.84        0.22
```

```
PRC: HIS



AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00     117  16.9 [*********
      7.00     136  19.7 [**********
      8.00     149  21.5 [***********
      9.00      66   9.5 [*****
     10.00      46   6.6 [****
     11.00      46   6.6 [****
     12.00      32   4.6 [***
     13.00      23   3.3 [**
     14.00       9   1.3 [*
     15.00      20   2.8 [**
     16.00      12   1.7 [*
     17.00       6   0.8 [*
     18.00       6   0.8 [*
     19.00       7   1.0 [*
     20.00       2   0.2 [*
     21.00       1   0.1 [*
     22.00       3   0.4 [*
     23.00       2   0.2 [*
     24.00       3   0.4 [*
     25.00       0   0.0 [
     26.00       1   0.1 [*
     27.00       1   0.1 [*
     28.00       0   0.0 [
     29.00       0   0.0 [
     30.00       2   0.2 [*
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00      27  13.8 [*******
      7.00      40  20.5 [***********
      8.00      38  19.4 [**********
      9.00      23  11.7 [******
     10.00      19   9.7 [*****
     11.00      11   5.6 [***
     12.00      10   5.1 [***
     13.00       7   3.5 [**
     14.00       5   2.5 [**
     15.00       5   2.5 [**
     16.00       3   1.5 [*
     17.00       1   0.5 [*
     18.00       0   0.0 [
     19.00       2   1.0 [*
     20.00       0   0.0 [
     21.00       0   0.0 [
     22.00       1   0.5 [*
     23.00       0   0.0 [
     24.00       1   0.5 [*
     25.00       0   0.0 [
     26.00       0   0.0 [
     27.00       1   0.5 [*
     28.00       0   0.0 [
     29.00       0   0.0 [
     30.00       1   0.5 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       9  23.6 [*************
     7.00       6  15.7 [*********
     8.00      12  31.5 [*****************
     9.00       4  10.5 [******
    10.00       0   0.0 [
    11.00       3   7.8 [****
    12.00       0   0.0 [
    13.00       2   5.2 [***
    14.00       0   0.0 [
    15.00       1   2.6 [**
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       1   2.6 [**
    19.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      10  21.2 [************
     7.00       9  19.1 [***********
     8.00      13  27.6 [***************
     9.00       3   6.3 [****
    10.00       0   0.0 [
    11.00       8  17.0 [*********
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       1   2.1 [**
    18.00       0   0.0 [
    19.00       1   2.1 [**
    20.00       0   0.0 [
    21.00       1   2.1 [**
    22.00       1   2.1 [**
    23.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       2  11.1 [******
     7.00       3  16.6 [*********
     8.00       5  27.7 [**************
     9.00       1   5.5 [***
    10.00       1   5.5 [***
    11.00       1   5.5 [***
    12.00       3  16.6 [*********
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       1   5.5 [***
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       1   5.5 [***
    27.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  13   NAME: HALITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       1  50.0 [**************************
    11.00       0   0.0 [
    12.00       1  50.0 [**************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       1  20.0 [***********
     8.00       1  20.0 [***********
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       1  20.0 [***********
    13.00       1  20.0 [***********
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1  20.0 [***********

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1   5.8 [***
     7.00       2  11.7 [******
     8.00       2  11.7 [******
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       3  17.6 [*********
    13.00       0   0.0 [
    14.00       1   5.8 [***
    15.00       1   5.8 [***
    16.00       2  11.7 [******
    17.00       3  17.6 [*********
    18.00       0   0.0 [
    19.00       1   5.8 [***
    20.00       1   5.8 [***
    21.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  25.0 [*************
     7.00       1  25.0 [*************
     8.00       1  25.0 [*************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       1  25.0 [*************
    25.00       0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      15  21.7 [***********
     7.00      12  17.3 [*********
     8.00      15  21.7 [***********
     9.00      10  14.4 [********
    10.00       8  11.5 [******
    11.00       3   4.3 [***
    12.00       1   1.4 [*
    13.00       2   2.8 [**
    14.00       0   0.0 [
    15.00       1   1.4 [*
    16.00       2   2.8 [**
    17.00       0   0.0 [
.AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       16  17.0 [*********
     7.00       16  17.0 [*********
     8.00       12  12.7 [*******
     9.00       11  11.7 [******
    10.00        6   6.3 [****
    11.00        8   8.5 [*****
    12.00        8   8.5 [*****
    13.00        5   5.3 [***
    14.00        0   0.0 [
    15.00        3   3.1 [**
    16.00        2   2.1 [**
    17.00        0   0.0 [
    18.00        3   3.1 [**
    19.00        1   1.0 [*
    20.00        1   1.0 [*
    21.00        0   0.0 [
    22.00        0   0.0 [
    23.00        2   2.1 [**
    24.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       35  17.5 [*********
     7.00       45  22.6 [************
     8.00       50  25.1 [*************
     9.00       14   7.0 [****
    10.00       11   5.5 [***
    11.00       12   6.0 [****
    12.00        5   2.5 [**
    13.00        6   3.0 [**
    14.00        3   1.5 [*
    15.00        8   4.0 [***
    16.00        3   1.5 [*
    17.00        1   0.5 [*
    18.00        2   1.0 [*
    19.00        1   0.5 [*
    20.00        0   0.0 [
    21.00        0   0.0 [
    22.00        1   0.5 [*
    23.00        0   0.0 [
    24.00        1   0.5 [*
    25.00        0   0.0 [
    26.00        0   0.0 [
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        0   0.0 [
    30.00        1   0.5 [*
```

```
SUMMARY OF RESULTS      FILE NO.?36      MAGNIFICATION=                  500
                                         GUARD REGION=                 4.000 microns
LABEL: 85-197-P743-20-UNALTERED  500X    MINIMUM PARTICLE SIZE=        0.500 microns
NUMBER OF FRAMES              3          MAXIMUM PARTICLE SIZE=        7.500 microns
NUMBER OF PARTICLES         661          LOW SHAPE FACTOR=             1.000
MAGNIFICATION               500          HIGH SHAPE FACTOR=            7.000
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um
ON PARTICLE SPACING=       0.04 um
FIELD AREA=          3.23E+04 um^2
TYPE           NAME                 AVE.DIA.              MAX        MAX/MIN     AREA       PERIMETER
                                    MICRONS               MICRONS                uM^2       MICRONS
  0  ALL TYPES              2.44E+00 +-  1.87E+00    4.11E+00    3.05E+00   7.992E+00  1.073E+01
  1  PYRITE                 3.40E+00 +-  2.16E+00    4.82E+00    1.89E+00   1.313E+01  1.299E+01
  2  KAOLINITE              6.23E+00 +-  3.48E+00    1.21E+01    4.07E+00   4.352E+01  2.966E+01
  3  ILLITE                 2.67E+00 +-  8.22E-01    4.64E+00    2.78E+00   6.584E+00  1.106E+01
  4  QUARTZ                 4.61E+00 +-  3.04E+00    6.45E+00    1.96E+00   2.389E+01  1.723E+01
  7  ANKERITE               9.22E-01 +-  0.00E+00    3.03E+00    8.62E+00   8.738E-01  6.240E+00
  8  DOLOMITE               1.02E+00 +-  6.71E-02    2.43E+00    4.60E+00   9.903E-01  5.361E+00
 13  HALITE                 7.47E-01 +-  0.00E+00    9.66E-01    1.46E+00   5.030E-01  2.768E+00
 15  APATITE                1.75E+00 +-  6.21E-02    2.15E+00    1.44E+00   2.480E+00  6.306E+00
 20  ORGANIC SULPHUR        3.29E+00 +-  0.00E+00    4.43E+00    1.77E+00   8.735E+00  1.188E+01
 21  FeS (?)                3.44E+00 +-  2.68E+00    5.89E+00    3.36E+00   1.436E+01  1.681E+01
 24  POLISH                 2.31E+00 +-  1.55E+00    4.21E+00    3.28E+00   6.701E+00  1.071E+01
 62  NON-INT                2.43E+00 +-  2.05E+00    3.72E+00    3.16E+00   8.241E+00  1.033E+01
 63  UNKNOWN                1.81E+00 +-  1.31E+00    3.05E+00    3.05E+00   4.279E+00  8.059E+00

PARTICLE COUNT SUMMARY
TYPE           NAME                NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                       661     100.00       5.43
  1  PYRITE                           71      10.74       0.95
  2  KAOLINITE                        12       1.81       0.53
  3  ILLITE                            9       1.36       0.06
  4  QUARTZ                           11       1.66       0.27
  7  ANKERITE                          1       0.15       0.00
  8  DOLOMITE                          3       0.45       0.00
 13  HALITE                            1       0.15       0.00
 15  APATITE                           2       0.30       0.00
 20  ORGANIC SULPHUR                   2       0.30       0.01
 21  FeS (?)                           6       0.90       0.08
 24  POLISH                          296      44.78       2.04
 62  NON-INT                          89      13.46       0.75
 63  UNKNOWN                         158      23.90       0.69


                                             THRESHOLDS:  LOWER=  60  UPPER= 255
 FRAME NO.    1
 TOTAL NO OF PARTICLES FOR FRAME=   99       FRAME NO.    2
                                             TOTAL NO OF PARTICLES FOR FRAME=  240
THRESHOLDS:  LOWER=  82  UPPER= 255

                                            THRESHOLDS:  LOWER=  60  UPPER= 255

                                            FRAME NO.    3
                                            TOTAL NO OF PARTICLES FOR FRAME=  322
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      57   8.6 [*****
     1.00      60   9.0 [*****
     1.25      71  10.7 [******
     1.50      72  10.8 [******
     1.75      45   6.8 [****
     2.00      50   7.5 [****
     2.25      52   7.8 [****
     2.50      38   5.7 [***
     2.75      20   3.0 [**
     3.00      22   3.3 [**
     3.25      19   2.8 [**
     3.50      24   3.6 [**
     3.75      20   3.0 [**
     4.00      10   1.5 [*
     4.25      10   1.5 [*
     4.50       6   0.9 [*
     4.75      13   1.9 [*
     5.00      10   1.5 [*
     5.25       3   0.4 [*
     5.50       6   0.9 [*
     5.75       3   0.4 [*
     6.00       6   0.9 [*
     6.25       5   0.7 [*
     6.50       3   0.4 [*
     6.75       3   0.4 [*
     7.00       3   0.4 [*
     7.25       4   0.6 [*
     7.50      26   3.9 [**

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2   2.8 [**
     1.00       0   0.0 [
     1.25       5   7.0 [****
     1.50       7   9.8 [*****
     1.75       2   2.8 [**
     2.00       6   8.4 [*****
     2.25       7   9.8 [*****
     2.50       4   5.6 [***
     2.75       4   5.6 [***
     3.00       4   5.6 [***
     3.25       3   4.2 [***
     3.50       3   4.2 [***
     3.75       2   2.8 [**
     4.00       1   1.4 [*
     4.25       0   0.0 [
     4.50       1   1.4 [*
     4.75       3   4.2 [***
     5.00       0   0.0 [
     5.25       1   1.4 [*
     5.50       1   1.4 [*
     5.75       0   0.0 [
     6.00       2   2.8 [**
     6.25       3   4.2 [***
     6.50       0   0.0 [
     6.75       2   2.8 [**
     7.00       0   0.0 [
     7.25       2   2.8 [**
     7.50       6   8.4 [*****
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       1   8.3 [*****
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       1   8.3 [*****
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1   8.3 [*****
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       1   8.3 [*****
     4.75       0   0.0 [
     5.00       1   8.3 [*****
     5.25       0   0.0 [
     5.50       1   8.3 [*****
     5.75       1   8.3 [*****
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       5  41.6 [*********************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       1  11.1 [******
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       1  11.1 [******
     2.25       1  11.1 [******
     2.50       1  11.1 [******
     2.75       1  11.1 [******
     3.00       0   0.0 [
     3.25       1  11.1 [******
     3.50       1  11.1 [******
     3.75       2  22.2 [************
     4.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       2  18.1 [**********
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1   9.0 [*****
     3.25       1   9.0 [*****
     3.50       1   9.0 [*****
     3.75       2  18.1 [**********
     4.00       0   0.0 [
     4.25       1   9.0 [*****
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       3  27.2 [**************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   7   NAME: ANKERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   8   NAME: DOLOMITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1  33.3 [*****************
     1.25       2  66.6 [**********************************
     1.50       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  13   NAME: HALITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       1  50.0 [**************************
     2.00       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       2 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       1  16.6 [*********
     1.50       1  16.6 [*********
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       1  16.6 [*********
     2.75       0   0.0 [
     3.00       1  16.6 [*********
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       1  16.6 [*********
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       1  16.6 [*********
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      26   8.7 [*****
     1.00      25   8.4 [*****
     1.25      26   8.7 [*****
     1.50      23   7.7 [****
     1.75      28   9.4 [*****
     2.00      28   9.4 [*****
     2.25      28   9.4 [*****
     2.50      20   6.7 [****
     2.75      10   3.3 [**
     3.00       9   3.0 [**
     3.25      11   3.7 [**
     3.50      11   3.7 [**
     3.75      10   3.3 [**
     4.00       4   1.3 [*
     4.25       5   1.6 [*
     4.50       2   0.6 [*
     4.75       5   1.6 [*
     5.00       5   1.6 [*
     5.25       1   0.3 [*
     5.50       4   1.3 [*
     5.75       2   0.6 [*
     6.00       2   0.6 [*
     6.25       1   0.3 [*
     6.50       1   0.3 [*
     6.75       1   0.3 [*
     7.00       2   0.6 [*
     7.25       2   0.6 [*
     7.50       4   1.3 [*
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      11  12.3 [*******
     1.00      13  14.6 [********
     1.25       8   8.9 [*****
     1.50      13  14.6 [********
     1.75       4   4.4 [***
     2.00       2   2.2 [**
     2.25       4   4.4 [***
     2.50       5   5.6 [***
     2.75       2   2.2 [**
     3.00       3   3.3 [**
     3.25       3   3.3 [**
     3.50       1   1.1 [*
     3.75       1   1.1 [*
     4.00       0   0.0 [
     4.25       3   3.3 [**
     4.50       2   2.2 [**
     4.75       3   3.3 [**
     5.00       2   2.2 [**
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       1   1.1 [*
     6.25       1   1.1 [*
     6.50       2   2.2 [**
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       5   5.6 [***
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      17  10.7 [******
     1.00      20  12.6 [*******
     1.25      28  17.7 [*********
     1.50      25  15.8 [********
     1.75      10   6.3 [****
     2.00      12   7.5 [****
     2.25      11   6.9 [****
     2.50       7   4.4 [***
     2.75       3   1.8 [*
     3.00       3   1.8 [*
     3.25       0   0.0 [
     3.50       5   3.1 [**
     3.75       3   1.8 [*
     4.00       5   3.1 [**
     4.25       1   0.6 [*
     4.50       0   0.0 [
     4.75       1   0.6 [*
     5.00       2   1.2 [*
     5.25       1   0.6 [*
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       1   0.6 [*
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       1   0.6 [*
     7.25       0   0.0 [
     7.50       2   1.2 [*
```

```
PRC: REPORT
                              FILE NO.?43
                              DRIVE NO.?2
                              LABEL: P743-200-RAW-50X

SUMMARY OF RESULTS

LABEL: 85-197-P743-200-UNALTERED(CM)    50X
NUMBER OF FRAMES              10
NUMBER OF PARTICLES          136
MAGNIFICATION                 50
FIELD WIDTH=           1799.56 um
OFF PARTICLE SPACING=     4.83 um
ON PARTICLE SPACING=      0.43 um
FIELD AREA=            3.23E+06 um^2
```

```
LABEL: 85-197-P743-200-UNALTERED(CM)    50X
MAGNIFICATION=                       50
GUARD REGION=                    15.000 microns
MINIMUM PARTICLE SIZE=            5.000 microns
MAXIMUM PARTICLE SIZE=           30.000 microns
LOW SHAPE FACTOR=                 1.000
HIGH SHAPE FACTOR=                7.000
```

```
TYPE           NAME              AVE.DIA.             MAX       MAX/MIN     AREA      PERIMETER
                                 MICRONS            MICRONS                 uM^2      MICRONS
  0  ALL TYPES           9.03E+00 +-  4.23E+00   1.46E+01   3.05E+00  8.718E+01  3.973E+01
  1  PYRITE              8.89E+00 +-  3.73E+00   1.26E+01   3.08E+00  7.811E+01  3.618E+01
  2  KAOLINITE           8.61E+00 +-  2.96E+00   1.38E+01   2.84E+00  7.325E+01  3.788E+01
  3  ILLITE              8.43E+00 +-  3.46E+00   1.45E+01   2.92E+00  7.417E+01  3.735E+01
  4  QUARTZ              8.49E+00 +-  2.85E+00   1.36E+01   2.43E+00  6.707E+01  3.354E+01
  6  CALCITE             7.03E+00 +-  0.00E+00   8.34E+00   1.26E+00  4.123E+01  2.504E+01
 11  GYPSUM              5.27E+00 +-  0.00E+00   8.34E+00   2.37E+00  2.848E+01  2.285E+01
 13  HALITE              1.25E+01 +-  5.96E+00   1.55E+01   1.59E+00  1.507E+02  4.658E+01
 20  ORGANIC SULPHUR     6.59E+00 +-  0.00E+00   7.47E+00   1.30E+00  3.881E+01  2.504E+01
 21  FeS (?)             3.33E+01 +-  0.00E+00   4.87E+01   3.36E+00  9.347E+02  1.366E+02
 24  POLISH              7.54E+00 +-  1.59E+00   1.68E+01   4.71E+00  5.788E+01  4.094E+01
 62  NON-INT             1.12E+01 +-  4.78E+00   1.89E+01   2.56E+00  1.315E+02  5.229E+01
 63  UNKNOWN             8.81E+00 +-  4.73E+00   1.40E+01   2.81E+00  8.712E+01  3.830E+01

PARTICLE COUNT SUMMARY
TYPE           NAME                   NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                          136     100.00       0.03
  1  PYRITE                              36      26.47       0.00
  2  KAOLINITE                           32      23.52       0.00
  3  ILLITE                              10       7.35       0.00
  4  QUARTZ                               3       2.20       0.00
  6  CALCITE                              1       0.73       0.00
 11  GYPSUM                               1       0.73       0.00
 13  HALITE                               3       2.20       0.00
 20  ORGANIC SULPHUR                      1       0.73       0.00
 21  FeS (?)                              1       0.73       0.00
 24  POLISH                              17      12.50       0.00
 62  NON-INT                             13       9.55       0.00
 63  UNKNOWN                             18      13.23       0.00
```

```
THRESHOLDS:  LOWER=  48  UPPER= 255

FRAME NO.    1
TOTAL NO OF PARTICLES FOR FRAME=   24

FRAME NO.    2
TOTAL NO OF PARTICLES FOR FRAME=   31

FRAME NO.    3
TOTAL NO OF PARTICLES FOR FRAME=    6

FRAME NO.    4
TOTAL NO OF PARTICLES FOR FRAME=   21

FRAME NO.    5
TOTAL NO OF PARTI
```

```
FRAME NO.    6
TOTAL NO OF PARTICLES FOR FRAME=    8

FRAME NO.    7
TOTAL NO OF PARTICLES FOR FRAME=    9

FRAME NO.    8
TOTAL NO OF PARTICLES FOR FRAME=   15

FRAME NO.    9
TOTAL NO OF PARTICLES FOR FRAME=   10

THRESHOLDS:  LOWER=  48  UPPER= 255

FRAME NO.   10
TOTAL NO OF PARTICLES FOR FRAME=    5
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       29  21.3 [***********
     7.00       21  15.4 [********
     8.00       21  15.4 [********
     9.00       11   8.0 [*****
    10.00       14  10.2 [******
    11.00       13   9.5 [*****
    12.00       10   7.3 [****
    13.00        1   0.7 [*
    14.00        2   1.4 [*
    15.00        4   2.9 [**
    16.00        1   0.7 [*
    17.00        1   0.7 [*
    18.00        2   1.4 [*
    19.00        2   1.4 [*
    20.00        0   0.0 [
    21.00        2   1.4 [*
    22.00        0   0.0 [
    23.00        0   0.0 [
    24.00        0   0.0 [
    25.00        0   0.0 [
    26.00        1   0.7 [*
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        0   0.0 [
    30.00        1   0.7 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        8  22.2 [************
     7.00        3   8.3 [*****
     8.00        6  16.6 [*********
     9.00        4  11.1 [******
    10.00        2   5.5 [***
    11.00        8  22.2 [************
    12.00        2   5.5 [***
    13.00        0   0.0 [
    14.00        1   2.7 [**
    15.00        1   2.7 [**
    16.00        0   0.0 [
    17.00        0   0.0 [
    18.00        0   0.0 [
    19.00        0   0.0 [
    20.00        0   0.0 [
    21.00        0   0.0 [
    22.00        0   0.0 [
    23.00        0   0.0 [
    24.00        0   0.0 [
    25.00        0   0.0 [
    26.00        1   2.7 [**
    27.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       5  15.6 [********
     7.00       8  25.0 [*************
     8.00       3   9.3 [*****
     9.00       2   6.2 [****
    10.00       6  18.7 [**********
    11.00       4  12.5 [*******
    12.00       1   3.1 [**
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       2   6.2 [****
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       1   3.1 [**
    19.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       3  30.0 [****************
     7.00       3  30.0 [****************
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       1  10.0 [******
    11.00       0   0.0 [
    12.00       2  20.0 [***********
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       1  10.0 [******

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  33.3 [*****************
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       1  33.3 [*****************
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       1  33.3 [*****************
    13.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  13   NAME: HALITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       1  33.3 [*****************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       1  33.3 [*****************
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1  33.3 [*****************
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       2  15.3 [********
     8.00       4  30.7 [****************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       3  23.0 [************
    13.00       1   7.6 [****
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       1   7.6 [****
    18.00       0   0.0 [
    19.00       1   7.6 [****
    20.00       0   0.0 [
    21.00       1   7.6 [****
    22.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       7  38.8 [********************
     7.00       3  16.6 [*********
     8.00       1   5.5 [***
     9.00       0   0.0 [
    10.00       3  16.6 [*********
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       1   5.5 [***
    15.00       1   5.5 [***
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       1   5.5 [***
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       1   5.5 [***
    22.00       0   0.0 [
PRC: REP

                                                                MAGNIFICATION=              500
                                                                GUARD REGION=             4.000 microns
SUMMARY OF RESULTS                                              MINIMUM PARTICLE SIZE=    0.500 microns
                                                                MAXIMUM PARTICLE SIZE=    7.500 microns
LABEL: 85-197-P743-200-UNALTERED(CM)  500X                      LOW SHAPE FACTOR=         1.000
NUMBER OF FRAMES             12                                 HIGH SHAPE FACTOR=        7.000
NUMBER OF PARTICLES         217
MAGNIFICATION               500
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um
ON PARTICLE SPACING=       0.04 um
FIELD AREA=            3.23E+04 um^2
TYPE          NAME                    AVE.DIA.                MAX       MAX/MIN      AREA      PERIMETER
                                      MICRONS               MICRONS                  uM^2      MICRONS
  0  ALL TYPES               1.85E+00 +-  1.76E+00     3.45E+00     3.20E+00  5.747E+00  8.549E+00
  1  PYRITE                  2.68E+00 +-  2.09E+00     3.91E+00     1.88E+00  1.016E+01  1.045E+01
  2  KAOLINITE               2.86E+00 +-  1.32E+00     4.62E+00     2.50E+00  8.429E+00  1.158E+01
  3  ILLITE                  2.02E+00 +-  1.49E+00     3.10E+00     2.36E+00  4.918E+00  7.789E+00
  4  QUARTZ                  2.88E+00 +-  1.35E+00     5.17E+00     2.67E+00  7.837E+00  1.209E+01
  5  SIDERITE                1.18E+00 +-  0.00E+00     1.53E+00     1.94E+00  1.305E+00  4.746E+00
 11  GYPSUM                  3.47E+00 +-  0.00E+00     4.30E+00     1.53E+00  9.632E+00  1.177E+01
 16  MONAZITE                1.80E+00 +-  0.00E+00     2.02E+00     1.58E+00  2.618E+00  6.591E+00
 19  CHALCOPYRITE            8.34E-01 +-  2.48E-01     1.14E+00     1.88E+00  6.257E-01  3.537E+00
 21  FeS (?)                 6.50E+00 +-  6.09E+00     1.19E+01     2.90E+00  5.391E+01  2.983E+01
 22  ILLITE + Ti             7.69E-01 +-  2.17E-01     1.25E+00     2.97E+00  5.532E-01  3.208E+00
 23  ZIRCON                  5.93E-01 +-  3.10E-02     9.22E-01     2.35E+00  3.427E-01  2.592E+00
 24  POLISH                  2.51E+00 +-  2.50E+00     7.17E+00     5.08E+00  1.126E+01  1.567E+01
 62  NON-INT                 9.30E-01 +-  7.00E-01     1.37E+00     3.87E+00  1.153E+00  3.972E+00
 63  UNKNOWN                 1.25E+00 +-  7.18E-01     1.94E+00     2.65E+00  1.782E+00  5.271E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                  NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                        217     100.00       0.32
  1  PYRITE                            26      11.98       0.06
  2  KAOLINITE                         23      10.59       0.04
  3  ILLITE                             8       3.68       0.01
  4  QUARTZ                             3       1.38       0.00
  5  SIDERITE                           1       0.46       0.00
 11  GYPSUM                             1       0.46       0.00
 16  MONAZITE                           1       0.46       0.00
 19  CHALCOPYRITE                       2       0.92       0.00
 21  FeS (?)                            2       0.92       0.02
 22  ILLITE + Ti                        2       0.92       0.00
 23  ZIRCON                             2       0.92       0.00
 24  POLISH                            39      17.97       0.11
 62  NON-INT                           45      20.73       0.01
 63  UNKNOWN                           62      28.57       0.02

PRC: HIS
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      57  26.2 [**************
     1.00      26  11.9 [******
     1.25      27  12.4 [*******
     1.50      18   8.2 [*****
     1.75      10   4.6 [***
     2.00      14   6.4 [****
     2.25      16   7.3 [****
     2.50       7   3.2 [**
     2.75       3   1.3 [*
     3.00       6   2.7 [**
     3.25       3   1.3 [*
     3.50       1   0.4 [*
     3.75       8   3.6 [**
     4.00       1   0.4 [*
     4.25       4   1.8 [*
     4.50       2   0.9 [*
     4.75       3   1.3 [*
     5.00       0   0.0 [
     5.25       2   0.9 [*
     5.50       1   0.4 [*
     5.75       1   0.4 [*
     6.00       1   0.4 [*
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       6   2.7 [**

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       1   3.8 [**
     1.00       1   3.8 [**
     1.25       2   7.6 [****
     1.50       1   3.8 [**
     1.75       4  15.3 [********
     2.00       4  15.3 [********
     2.25       4  15.3 [********
     2.50       0   0.0 [
     2.75       1   3.8 [**
     3.00       3  11.5 [******
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       1   3.8 [**
     4.00       0   0.0 [
     4.25       1   3.8 [**
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       1   3.8 [**
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       2   7.6 [****
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       0   0.0 [
      1.00       0   0.0 [
      1.25       3  13.0 [*******
      1.50       2   8.6 [*****
      1.75       0   0.0 [
      2.00       1   4.3 [***
      2.25       2   8.6 [*****
      2.50       2   8.6 [*****
      2.75       1   4.3 [***
      3.00       3  13.0 [*******
      3.25       1   4.3 [***
      3.50       0   0.0 [
      3.75       3  13.0 [*******
      4.00       1   4.3 [***
      4.25       0   0.0 [
      4.50       1   4.3 [***
      4.75       1   4.3 [***
      5.00       0   0.0 [
      5.25       1   4.3 [***
      5.50       0   0.0 [
      5.75       0   0.0 [
      6.00       1   4.3 [***
      6.25       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       2  25.0 [*************
      1.00       0   0.0 [
      1.25       0   0.0 [
      1.50       2  25.0 [*************
      1.75       0   0.0 [
      2.00       1  12.5 [*******
      2.25       0   0.0 [
      2.50       1  12.5 [*******
      2.75       0   0.0 [
      3.00       0   0.0 [
      3.25       1  12.5 [*******
      3.50       0   0.0 [
      3.75       0   0.0 [
      4.00       0   0.0 [
      4.25       0   0.0 [
      4.50       0   0.0 [
      4.75       0   0.0 [
      5.00       0   0.0 [
      5.25       1  12.5 [*******
      5.50       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25       0   0.0 [
    0.50       0   0.0 [
    0.75       0   0.0 [
    1.00       0   0.0 [
    1.25       0   0.0 [
    1.50       0   0.0 [
    1.75       0   0.0 [
    2.00       1  33.3 [*****************
    2.25       1  33.3 [*****************
    2.50       0   0.0 [
    2.75       0   0.0 [
    3.00       0   0.0 [
    3.25       0   0.0 [
    3.50       0   0.0 [
    3.75       0   0.0 [
    4.00       0   0.0 [
    4.25       0   0.0 [
    4.50       1  33.3 [*****************
    4.75       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25       0   0.0 [
    0.50       0   0.0 [
    0.75       0   0.0 [
    1.00       0   0.0 [
    1.25       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25       0   0.0 [
    0.50       0   0.0 [
    0.75       0   0.0 [
    1.00       0   0.0 [
    1.25       0   0.0 [
    1.50       0   0.0 [
    1.75       0   0.0 [
    2.00       0   0.0 [
    2.25       0   0.0 [
    2.50       0   0.0 [
    2.75       0   0.0 [
    3.00       0   0.0 [
    3.25       0   0.0 [
    3.50       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25       0   0.0 [
    0.50       0   0.0 [
    0.75       0   0.0 [
    1.00       0   0.0 [
    1.25       0   0.0 [
    1.50       0   0.0 [
    1.75       0   0.0 [
    2.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  19   NAME: CHALCOPYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        1  50.0 [*************************
     1.00        0   0.0 [
     1.25        1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        0   0.0 [
     1.00        0   0.0 [
     1.25        0   0.0 [
     1.50        0   0.0 [
     1.75        0   0.0 [
     2.00        0   0.0 [
     2.25        1  50.0 [*************************
     2.50        0   0.0 [
     2.75        0   0.0 [
     3.00        0   0.0 [
     3.25        0   0.0 [
     3.50        0   0.0 [
     3.75        0   0.0 [
     4.00        0   0.0 [
     4.25        0   0.0 [
     4.50        0   0.0 [
     4.75        0   0.0 [
     5.00        0   0.0 [
     5.25        0   0.0 [
     5.50        0   0.0 [
     5.75        0   0.0 [
     6.00        0   0.0 [
     6.25        0   0.0 [
     6.50        0   0.0 [
     6.75        0   0.0 [
     7.00        0   0.0 [
     7.25        0   0.0 [
     7.50        1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        1  50.0 [*************************
     1.00        1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        2 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      6  15.3 [********
     1.00      4  10.2 [******
     1.25      4  10.2 [******
     1.50      3   7.6 [****
     1.75      5  12.8 [*******
     2.00      2   5.1 [***
     2.25      4  10.2 [******
     2.50      1   2.5 [**
     2.75      1   2.5 [**
     3.00      0   0.0 [
     3.25      0   0.0 [
     3.50      0   0.0 [
     3.75      1   2.5 [**
     4.00      0   0.0 [
     4.25      2   5.1 [***
     4.50      0   0.0 [
     4.75      2   5.1 [***
     5.00      0   0.0 [
     5.25      0   0.0 [
     5.50      1   2.5 [**
     5.75      0   0.0 [
     6.00      0   0.0 [
     6.25      0   0.0 [
     6.50      0   0.0 [
     6.75      0   0.0 [
     7.00      0   0.0 [
     7.25      0   0.0 [
     7.50      3   7.6 [****

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75     26  57.7 [*****************************
     1.00      9  20.0 [***********
     1.25      5  11.1 [******
     1.50      2   4.4 [***
     1.75      0   0.0 [
     2.00      0   0.0 [
     2.25      1   2.2 [**
     2.50      0   0.0 [
     2.75      0   0.0 [
     3.00      0   0.0 [
     3.25      0   0.0 [
     3.50      0   0.0 [
     3.75      1   2.2 [**
     4.00      0   0.0 [
     4.25      1   2.2 [**
     4.50      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25        0   0.0 [
    0.50        0   0.0 [
    0.75       18  29.0 [***************
    1.00       11  17.7 [*********
    1.25       11  17.7 [*********
    1.50        8  12.9 [*******
    1.75        1   1.6 [*
    2.00        4   6.4 [****
    2.25        3   4.8 [***
    2.50        3   4.8 [***
    2.75        0   0.0 [
    3.00        0   0.0 [
    3.25        1   1.6 [*
    3.50        0   0.0 [
    3.75        2   3.2 [**
    4.00        0   0.0 [

    THRESHOLDS:  LOWER=  63  UPPER= 255
    FRAME NO.    1
    TOTAL NO OF PARTICLES FOR FRAME=   11        FRAME NO.    6
                                                 TOTAL NO OF PARTICLES FOR FRAME=   15
    FRAME NO.    2
    TOTAL NO OF PARTICLES FOR FRAME=   20        FRAME NO.    7
                                                 TOTAL NO OF PARTICLES FOR FRAME=   16
    FRAME NO.    3
    TOTAL NO OF PARTICLES FOR FRAME=   10        FRAME NO.    8
                                                 TOTAL NO OF PARTICLES FOR FRAME=   20
    FRAME NO.    4
    TOTAL NO OF PARTICLES FOR FRAME=   17        FRAME NO.    9
                                                 TOTAL NO OF PARTICLES FOR FRAME=   11
    FRAME NO.    5
    TOTAL NO OF PARTICLES FOR FRAME=   23



    THRESHOLDS:  LOWER=  71  UPPER= 255          THRESHOLDS:  LOWER=  71  UPPER= 255

    FRAME NO.   11                               FRAME NO.   10
    TOTAL NO OF PARTICLES FOR FRAME=   30        TOTAL NO OF PARTICLES FOR FRAME=    9

    THRESHOLDS:  LOWER=  71  UPPER= 255

    FRAME NO.   12
    TOTAL NO OF PARTICLES FOR FRAME=   35
```

```
PRC: REP

                                                      MAGNIFICATION=              50
                                                      GUARD REGION=           15.000 microns
SUMMARY OF RESULTS                                    MINIMUM PARTICLE SIZE=   5.000 microns
                                                      MAXIMUM PARTICLE SIZE=  30.000 microns
LABEL: 85-197-P743-400-CM 50X                         LOW SHAPE FACTOR=        1.000
NUMBER OF FRAMES             10                       HIGH SHAPE FACTOR=       7.000
NUMBER OF PARTICLES          73
MAGNIFICATION                50
FIELD WIDTH=          1799.56 um
OFF PARTICLE SPACING=    4.83 um
ON PARTICLE SPACING=     0.43 um
FIELD AREA=         3.23E+06 um^2
TYPE           NAME                  AVE.DIA.              MAX        MAX/MIN       AREA       PERIMETER
                                      MICRONS              MICRONS                  uM^2       MICRONS
  0  ALL TYPES               1.13E+01 +-  3.21E+01    1.68E+01    2.73E+00   8.885E+02  4.810E+01
  1  PYRITE                  8.71E+00 +-  2.77E+00    1.13E+01    1.73E+00   6.998E+01  3.200E+01
  2  KAOLINITE               7.47E+00 +-  0.00E+00    9.22E+00    1.39E+00   4.567E+01  2.636E+01
  3  ILLITE                  6.00E+00 +-  9.14E-01    8.49E+00    1.87E+00   3.122E+01  2.211E+01
  4  QUARTZ                  6.59E+00 +-  0.00E+00    9.66E+00    2.75E+00   3.765E+01  2.548E+01
 21  FeS (?)                 2.10E+01 +-  0.00E+00    3.03E+01    2.15E+00   3.607E+02  9.184E+01
 24  POLISH                  1.66E+01 +-  5.09E+01    2.40E+01    3.01E+00   2.138E+03  6.778E+01
 62  NON-INT                 7.14E+00 +-  4.41E+00    9.61E+00    1.92E+00   5.658E+01  2.828E+01
 63  UNKNOWN                 7.80E+00 +-  2.81E+00    1.30E+01    3.10E+00   6.029E+01  3.823E+01

PARTICLE COUNT SUMMARY
TYPE           NAME                 NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                        73      100.00       0.20
  1  PYRITE                            6        8.21       0.00
  2  KAOLINITE                         1        1.36       0.00
  3  ILLITE                            3        4.10       0.00
  4  QUARTZ                            1        1.36       0.00
 21  FeS (?)                           1        1.36       0.00
 24  POLISH                           29       39.72       0.19
 62  NON-INT                           8       10.95       0.00
 63  UNKNOWN                          24       32.87       0.00
```

```
85-197 P743-400 mesh cold mount
File 22        50x       video:32

Thresholds  Frame     Total
lower upper Number    Particles

  49   255         1        13
  49   255         2         8
  49   255         3         8
  49   255         4        10
  49   255         5         5
  49   255         6         7
  49   255         7         5
  49   255         8         7
  49   255         9         2
  49   255        10         8

            Average:       6.1
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      25  34.2 [******************
     7.00      13  17.8 [*********
     8.00      16  21.9 [***********
     9.00       8  10.9 [******
    10.00       3   4.1 [***
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       2   2.7 [**
    15.00       2   2.7 [**
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       2   2.7 [**
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       1   1.3 [*
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   1.3 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  16.6 [*********
     7.00       0   0.0 [
     8.00       2  33.3 [*****************
     9.00       1  16.6 [*********
    10.00       1  16.6 [*********
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       1  16.6 [*********
    15.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        0   0.0 [
     7.00        0   0.0 [
     8.00        1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        2  66.6 [*********************************
     7.00        0   0.0 [
     8.00        1  33.3 [****************
     9.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        0   0.0 [
     7.00        1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        0   0.0 [
     7.00        0   0.0 [
     8.00        0   0.0 [
     9.00        0   0.0 [
    10.00        0   0.0 [
    11.00        0   0.0 [
    12.00        0   0.0 [
    13.00        0   0.0 [
    14.00        0   0.0 [
    15.00        0   0.0 [
    16.00        0   0.0 [
    17.00        0   0.0 [
    18.00        0   0.0 [
    19.00        0   0.0 [
    20.00        0   0.0 [
    21.00        0   0.0 [
    22.00        1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00      0   0.0 [
     2.00      0   0.0 [
     3.00      0   0.0 [
     4.00      0   0.0 [
     5.00      0   0.0 [
     6.00     10  34.4 [******************
     7.00      4  13.7 [*******
     8.00      8  27.5 [**************
     9.00      5  17.2 [*********
    10.00      0   0.0 [
    11.00      0   0.0 [
    12.00      0   0.0 [
    13.00      0   0.0 [
    14.00      0   0.0 [
    15.00      0   0.0 [
    16.00      0   0.0 [
    17.00      0   0.0 [
    18.00      0   0.0 [
    19.00      1   3.4 [**
    20.00      0   0.0 [
    21.00      0   0.0 [
    22.00      0   0.0 [
    23.00      0   0.0 [
    24.00      0   0.0 [
    25.00      0   0.0 [
    26.00      0   0.0 [
    27.00      0   0.0 [
    28.00      0   0.0 [
    29.00      0   0.0 [
    30.00      1   3.4 [**
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       5  62.5 [********************************
     7.00       2  25.0 [*************
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1  12.5 [*******
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       7  29.1 [***************
     7.00       6  25.0 [*************
     8.00       4  16.6 [*********
     9.00       2   8.3 [*****
    10.00       2   8.3 [*****
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       1   4.1 [***
    15.00       2   8.3 [*****
    16.00       0   0.0 [
LABEL: 85-197-P743-400-CM 500X
NUMBER OF FRAMES             4
NUMBER OF PARTICLES         33
MAGNIFICATION              500
FIELD WIDTH=            179.95 um
OFF PARTICLE SPACING=     0.40 um
ON PARTICLE SPACING=      0.04 um
FIELD AREA=           3.23E+04 um^2
TYPE          NAME                  AVE.DIA.               MAX       MAX/MIN     AREA      PERIMETER
                                    MICRONS              MICRONS                 uM^2      MICRONS
  0  ALL TYPES               1.90E+00 +-  9.84E-01   3.27E+00   2.45E+00  4.138E+00  8.425E+00
  1  PYRITE                  1.58E+00 +-  0.00E+00   1.80E+00   1.28E+00  1.949E+00  5.581E+00
  2  KAOLINITE               2.94E+00 +-  0.00E+00   3.33E+00   1.30E+00  6.718E+00  9.536E+00
  3  ILLITE                  2.21E+00 +-  3.11E-01   3.51E+00   2.35E+00  4.455E+00  9.990E+00
 24  POLISH                  2.23E+00 +-  1.07E+00   4.19E+00   2.94E+00  5.687E+00  1.054E+01
 62  NON-INT                 1.01E+00 +-  2.04E-01   1.31E+00   1.60E+00  8.953E-01  3.691E+00
 63  UNKNOWN                 1.49E+00 +-  8.75E-01   2.48E+00   2.24E+00  2.496E+00  6.174E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                  NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                        33     100.00       0.10
  1  PYRITE                            1       3.03       0.00
  2  KAOLINITE                         1       3.03       0.00
  3  ILLITE                            3       9.09       0.01
 24  POLISH                           16      48.48       0.07
 62  NON-INT                           4      12.12       0.00
 63  UNKNOWN                           8      24.24       0.01
```

```
LABEL: 85-197-P743-400-CM 500X
MAGNIFICATION=                500
GUARD REGION=               4.000 microns
MINIMUM PARTICLE SIZE=      0.500 microns
MAXIMUM PARTICLE SIZE=      7.500 microns
LOW SHAPE FACTOR=           1.000
HIGH SHAPE FACTOR=          7.000
```

```
                                                   FILE NO.?24
                                                   DRIVE NO.?2
                                                   LABEL: 85-197-P743400CMX500
                                                   NO. OF VIDEO SAMPLES   32?
FRAME NO.    1
TOTAL NO OF PARTICLES FOR FRAME=   10

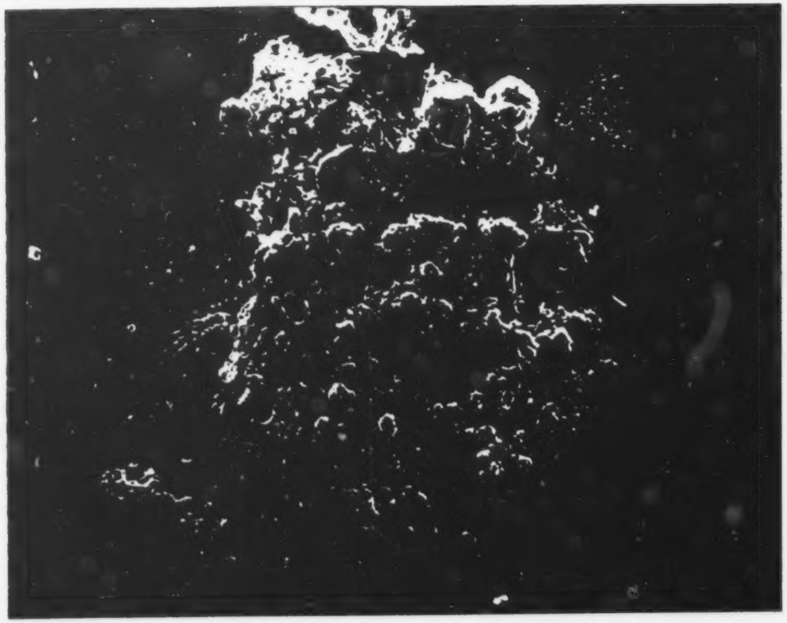
FRAME NO.    2
TOTAL NO OF PARTICLES FOR FRAME=    5        THRESHOLDS:  LOWER=  49  UPPER= 255

FRAME NO.    3                               FRAME NO.    4
TOTAL NO OF PARTICLES FOR FRAME=    5        TOTAL NO OF PARTICLES FOR FRAME=    5
```

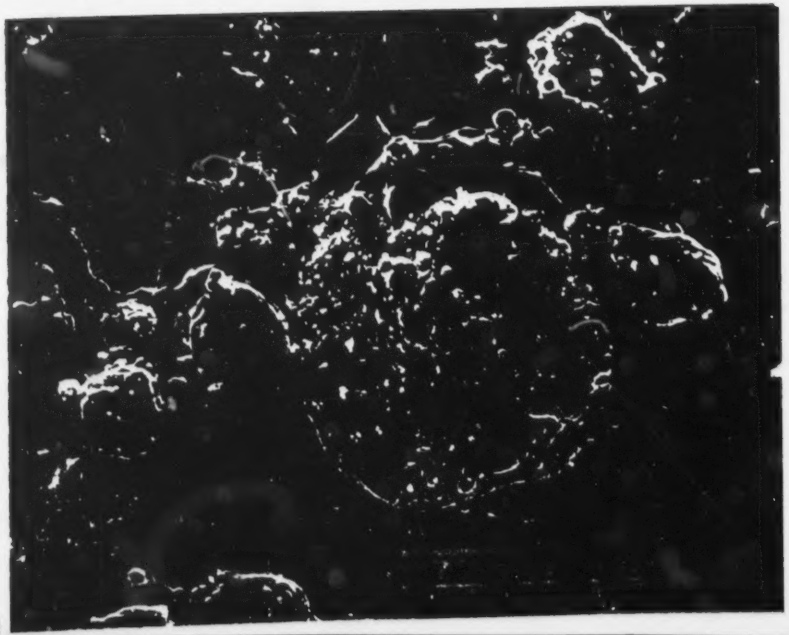
COMBUSTION RESIDUE: Plate #6
850°C, reducing atmosphere

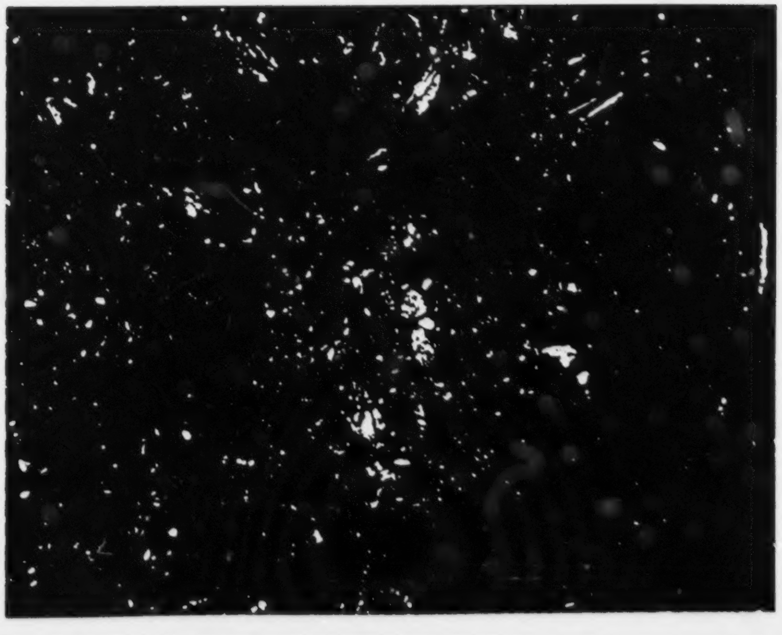
Western Coal: PS87, -20 mesh

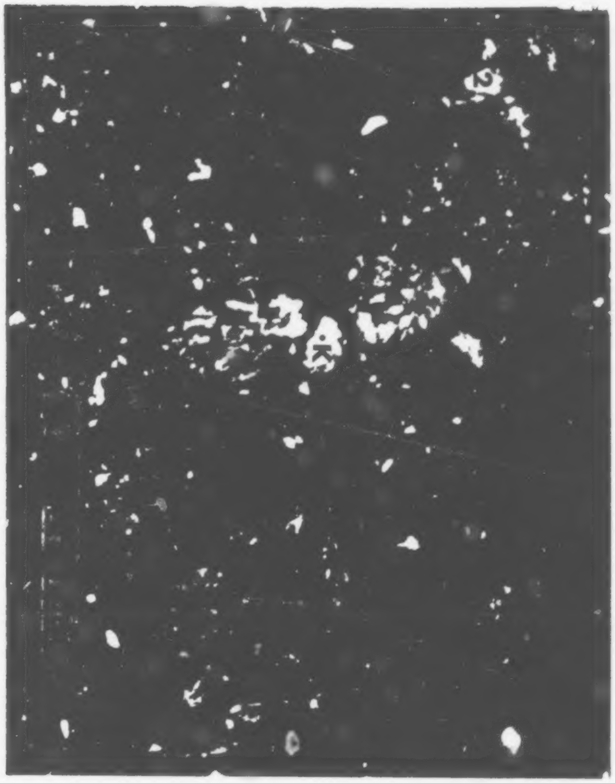
1.	0305-02	35X, SEI. High relief, globular morphology of residue mounted on Al stub with carbon paint and carbon coat.
2.	0305-01	35X, BEI. Same field in backscatter mode showing residual minerals as bright grains. Note the influence of relief on the BEI.
3.	0305-04	200X, SEI. Enlargement from #1 (0305-02) showing globules and spheres. These appear hollow (center right).
4.	0305-03	200X, BEI. Note abundant vesicles. Same view as above.
5.	0305-06	150X, SEI. Enlargement from #1 (0305-02).
6.	0305-05	150X, BEI. as above. Bright grains are minerals, e.g. calcite (c)
7.	0305-07	750X, BEI. Enlarged from photo 4 (0305-03). Minerals identified as kaolinite (K), quartz (Q), rutile (R), and "siderite" (S).
8.	0305-08	750X, SEI. Unaltered coal maceral. This illustrates incomplete combustion. Enlarged from photo 3 (0305-04).

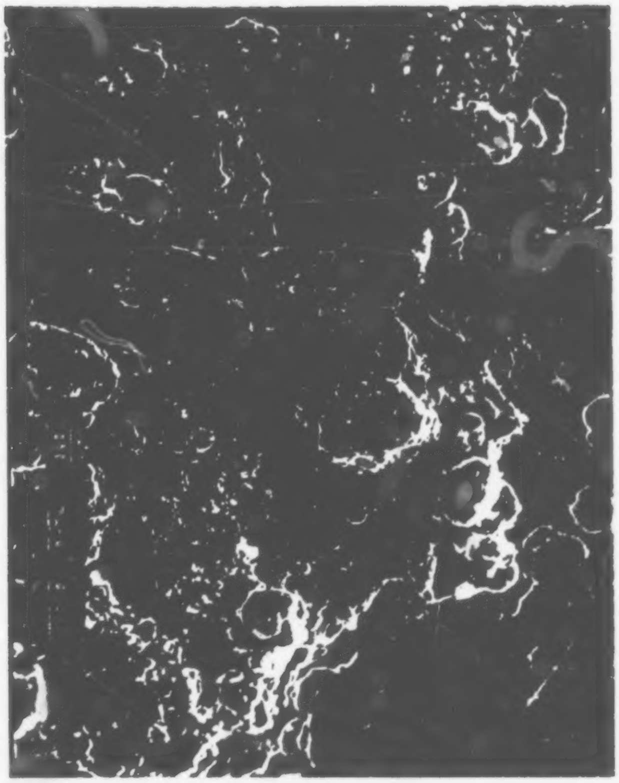

1

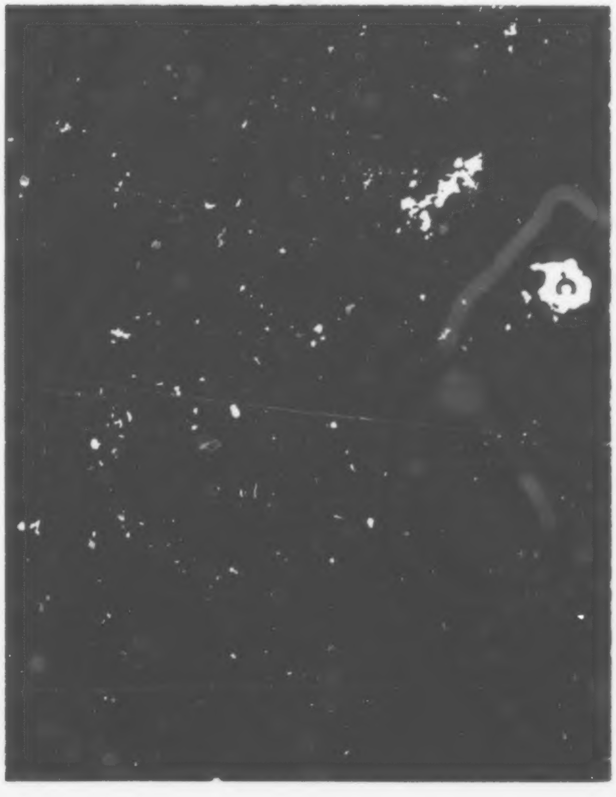
2


3


4







SPECTRA: SET #6
Combustion Residue: 850°C
reducing atmosphere

Spectrum: Sample: Westerm Coal: P587, -20 mesh

1. Kaolinite (K) All spectra are 20 Kv spot analyses for 50 seconds.

2. Carbonate - silicate (2) mixture. Possibly illite-calcite with some sulphur scavenged from the coal.

3. Iron oxide (or "siderite" S).

4. Rutile

5. Clay-carbonate mixture: likely kaolinite and apatite. Alternatively this could be a remnant feldspar.

6. Quartz.

7. Remnant coal maceral or coke: Note high background. Associated clays?

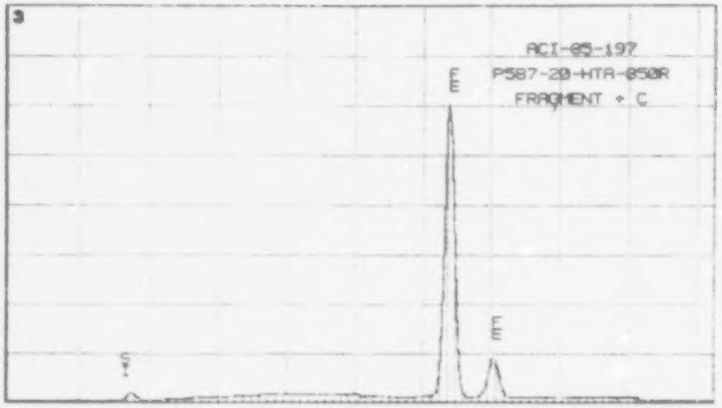
8. Coke: Note high titanium. Associated clays indicated by high Si, Al.

9. Calcite: some sulphur scavenging has occurred to yield $CaSO_4$.

Notes:

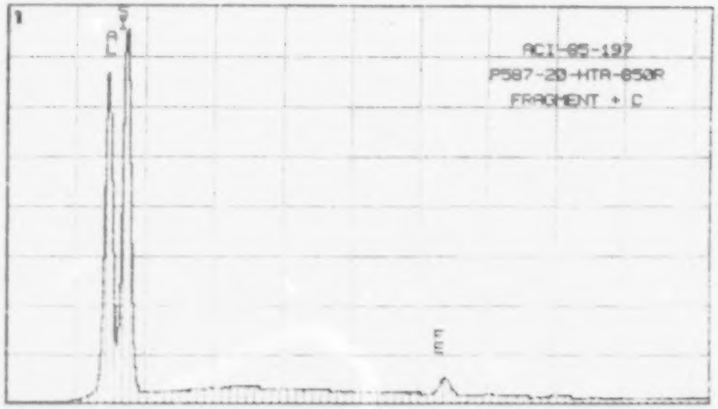
Mineralogy is dominated by quartz and kaolinite. No pyrite was identified and illite is rare. Traces of rutile. Some reaction products are indicated including a clay-carbonate assocation. Gypsum may have been present or sulphur from coal reacted with calcite to form $CaSO_4$. Remnant coal is evident, showing incomplete combustion.

ATLANTIC COAL INSTITUTE WED 05-MAR-86 13:22
Cursor: 0 000keV = 0



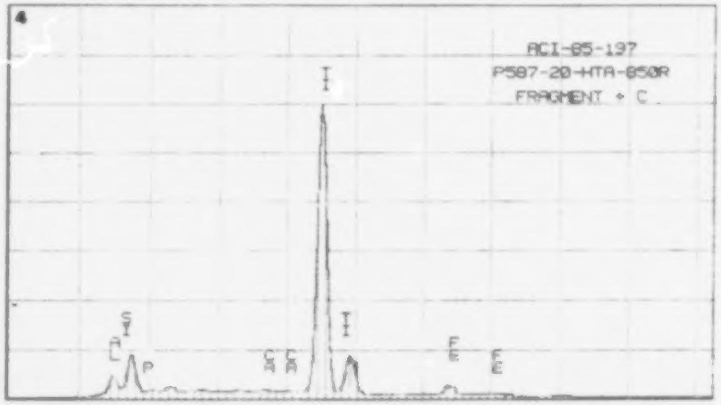
0 000 VFS = 16384 10 240
50 MINERAL: PHOTO# 0305-07.EDX3

ATLANTIC COAL INSTITUTE WED 05-MAR-86 13:17
Cursor: 0 000keV = 0



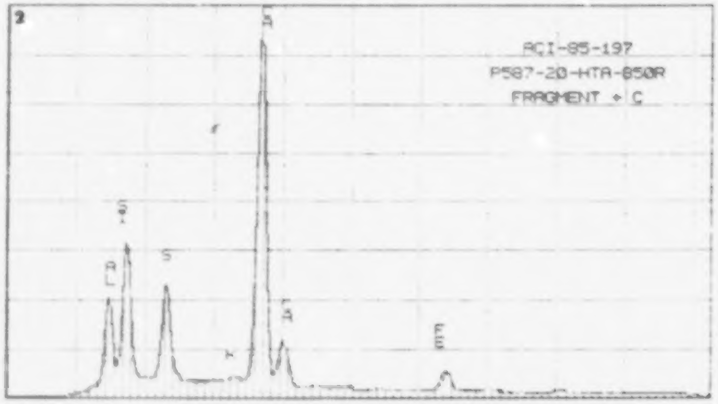
0 000 VFS = 8192 10 240
50 MINERAL: PHOTO# 0305-07.EDX1

ATLANTIC COAL INSTITUTE WED 05-MAR-86 13:24
Cursor: 0 000keV = 0



0 000 VFS = 16384 10 240
50 MINERAL: PHOTO# 0305-07.EDX4

ATLANTIC COAL INSTITUTE WED 05-MAR-86 13:20
Cursor: 0 000keV = 0



0 000 VFS = 8192 10 240
50 MINERAL: PHOTO# 0305-07.EDX2

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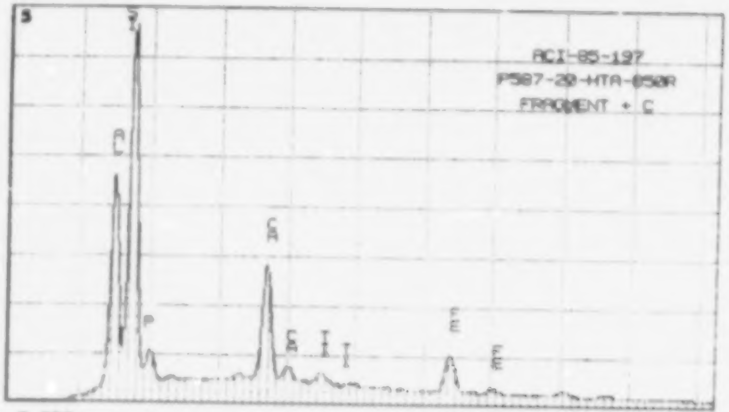

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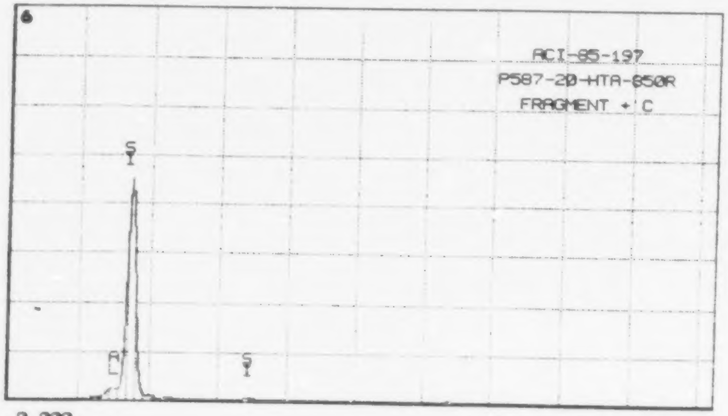

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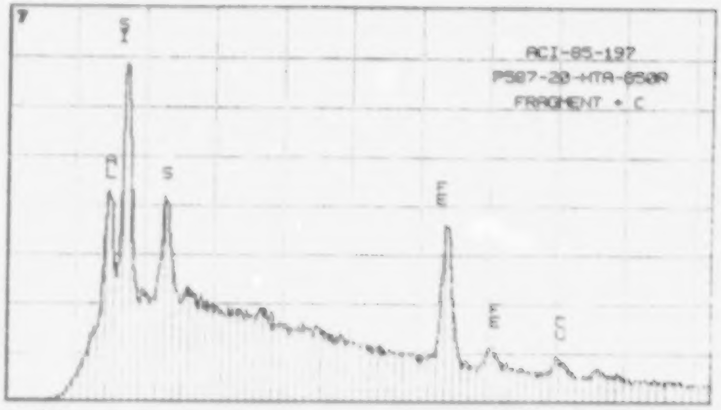

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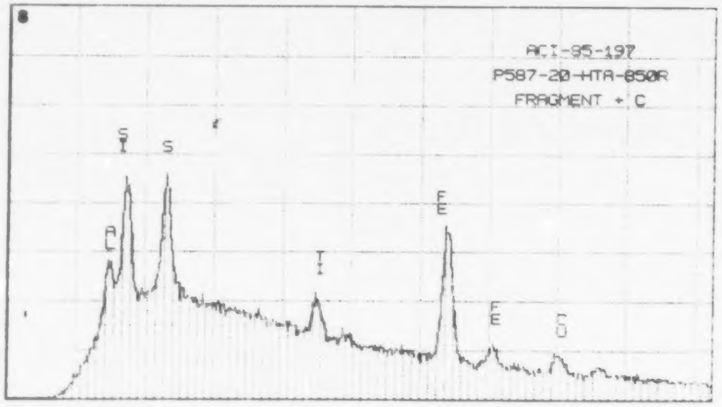

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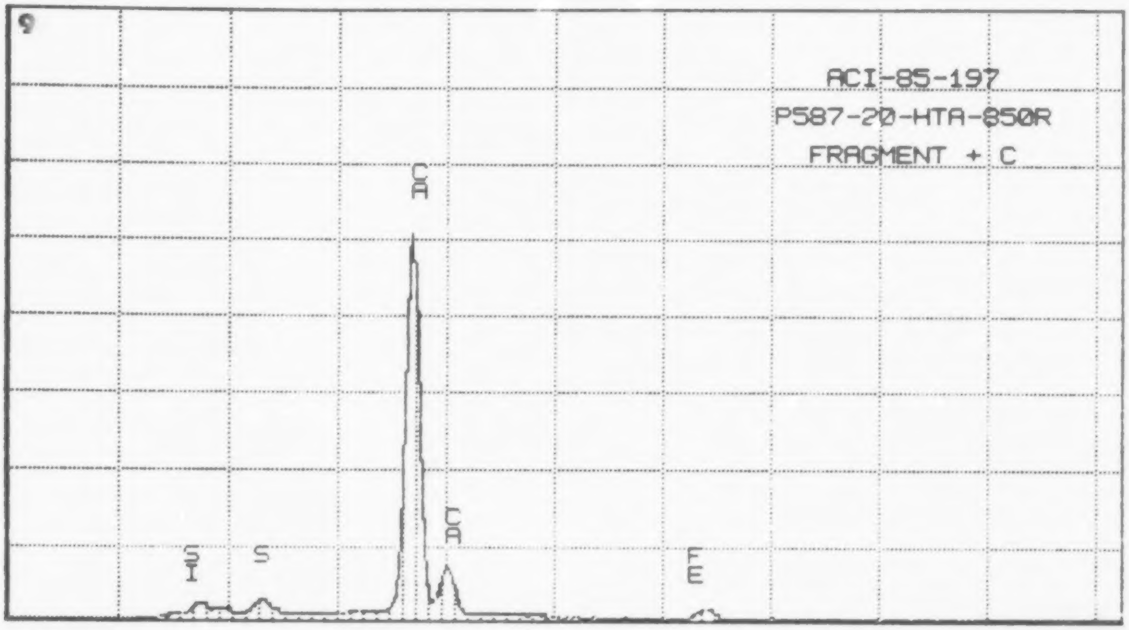

ACI-85-197

P587-20-HTA-850R

FRAGMENT + C

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50 MINERAL C PHOTO# 0305-05.EDX9

PHOTOMICROGRAPHS: PLATE #7
Western Canadian (-200)
Ash at 850°C reducing

Mounted as coke residue in leucite pellet. Carbon coated.

1. 0307-01 35X, BEI. Minerals present include: S=siderite (?), K=kaolinite, I=illinite, A=apatite (with kaolinite).

2. 0310-01 150X BEI, Enlarged #1. Minerals present: illite (I), siderite (S), kaolinite (K), possibly plagoclase (7), apatite (A).

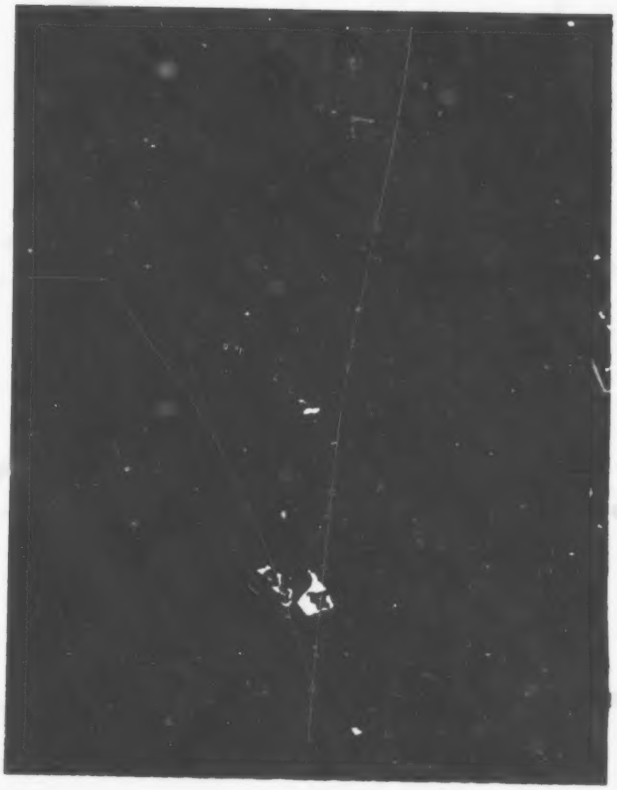
3. 0310-02 150X, BEI. Enlarged #1. Kaolinite (K), quartz (Q), illite (I), apatite (A, EDX 4) and illite with titanium (Z).

4. 0313-03 500X, BEI. Enlarged from #2. Vesicular coal (B, EDX 10) and encased minerals of kaolinite (K), apatite, siderite (bright grain, 7). Grain 8 is likely polish artifact.

5. 0313-02 2000X, BEI. Enlarged from #2. Apatite at crosshairs within kaolinite grain.

6. 0313-01 1500X, BEI. Enlarged from #2. The grain matrix is illite, but inclusions are trace element bearing: R-rutile (EDX 5), Ba=Ba, Sr mineral.

2



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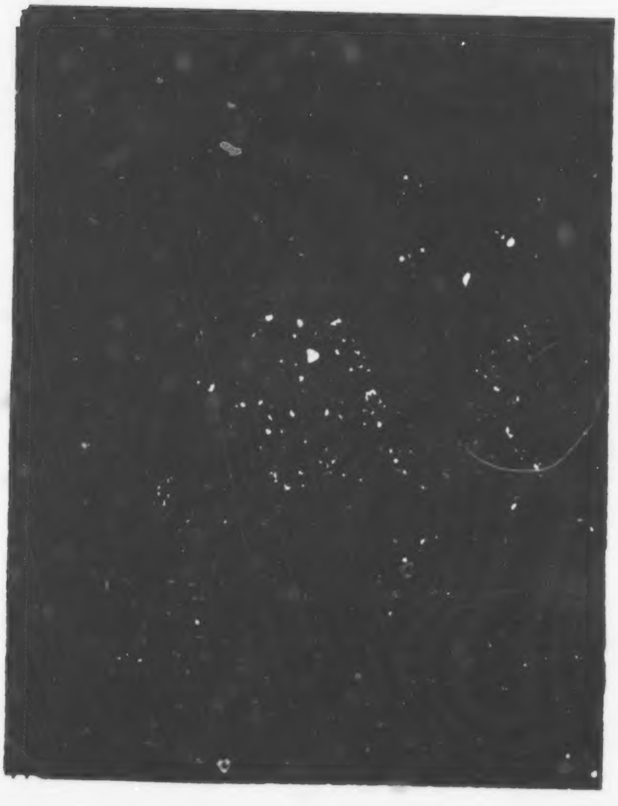

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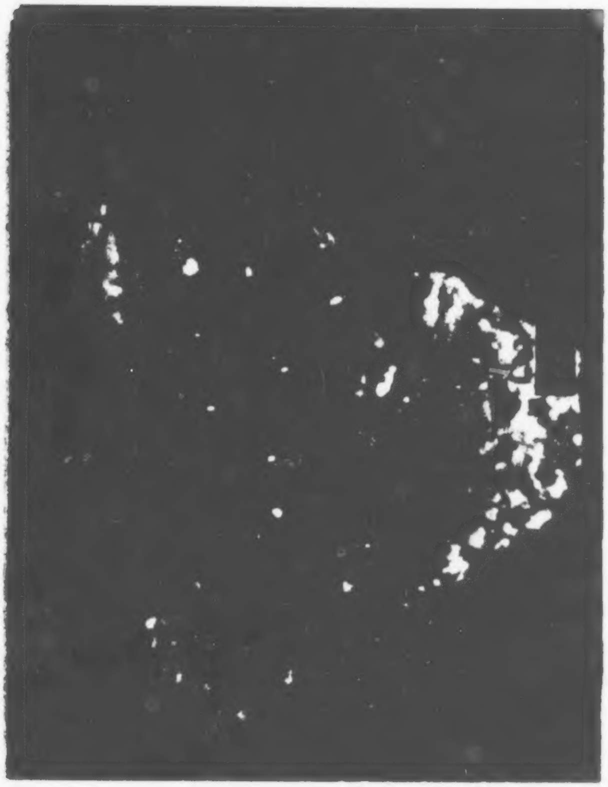

6

EDX SPECTRA SET #7
Western Canadian (-200)
Ash at 850°C, reducing

1. Kaolinite

2. Illite (note trace titanium)

3. Quartz

4. Apatite

5. Rutile: note associated potassium

6. Siderite: Note trace Ca, Mn, Mg suggesting solid solution series. This omits magnetite or hematite as possible ID.

7. Plagioclase? This is a rare spectrum for Eastern Canadian coals and may be derived from roof rock.

8. Aluminium polish (contaminant)

9. Coal (coke?, matrix giving very low count rates and only Fe and trace S present.

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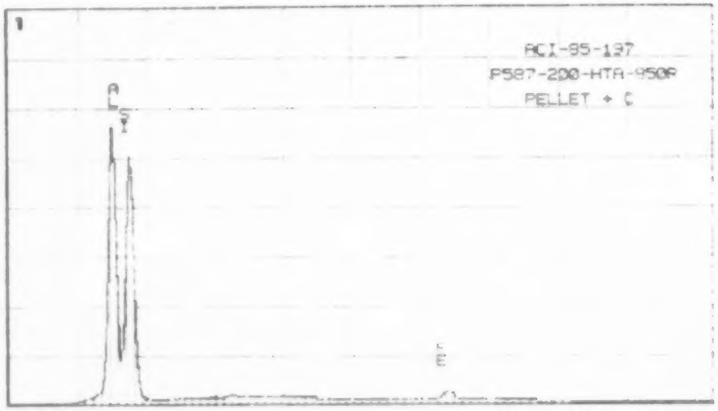

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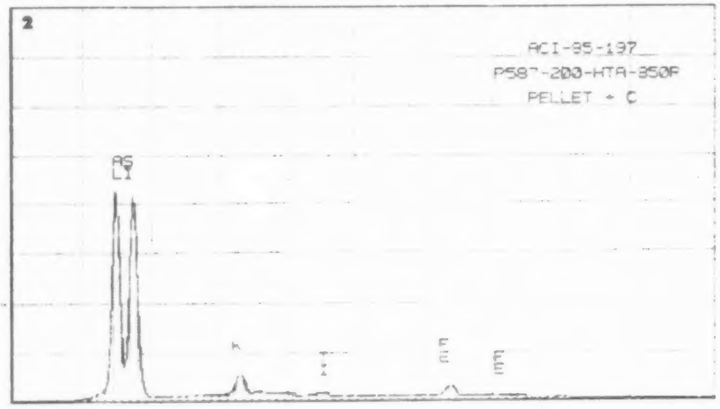

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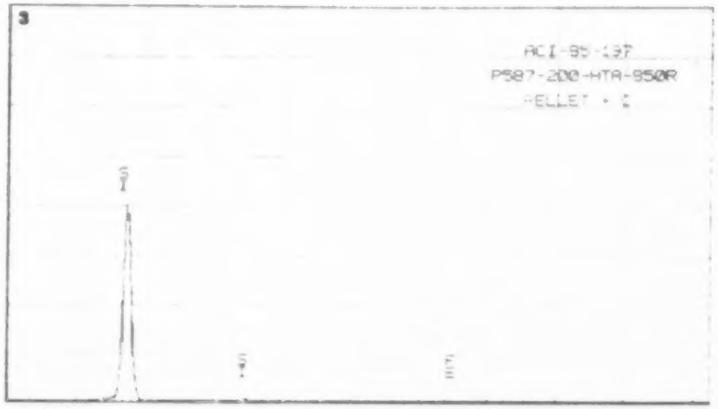

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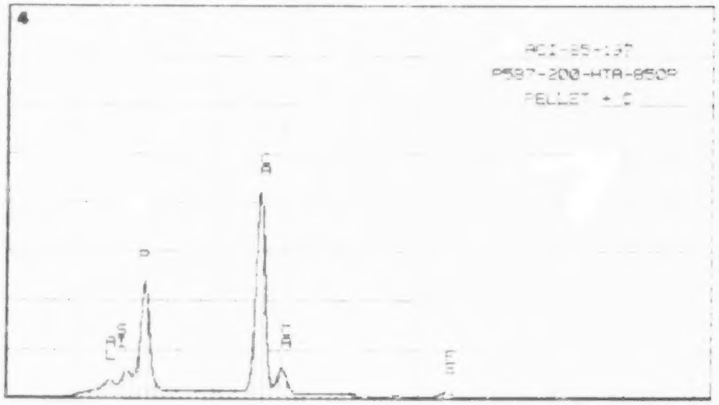

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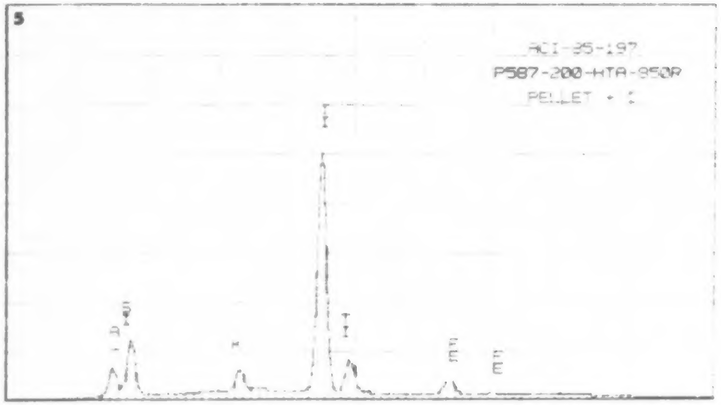

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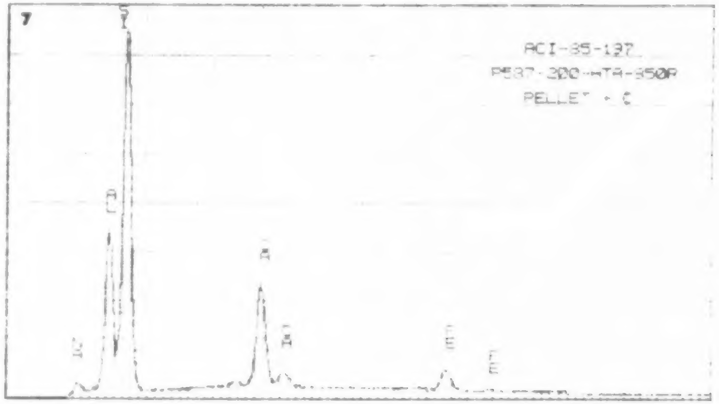

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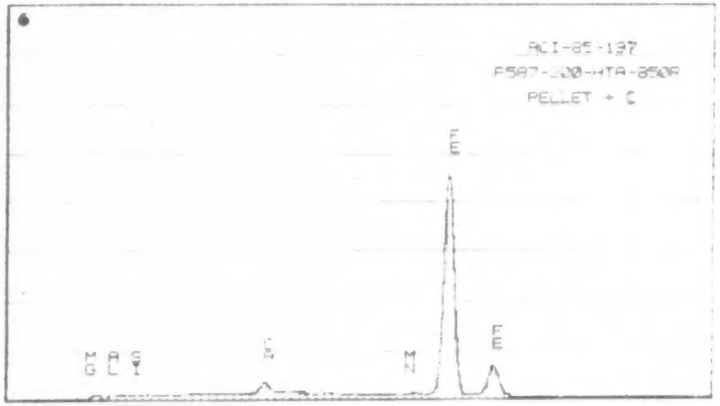

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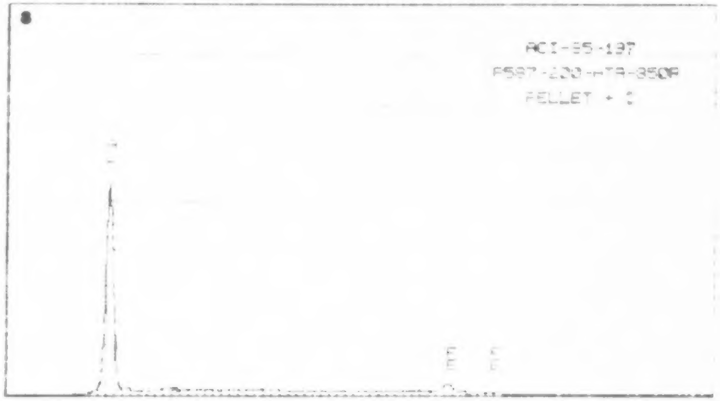

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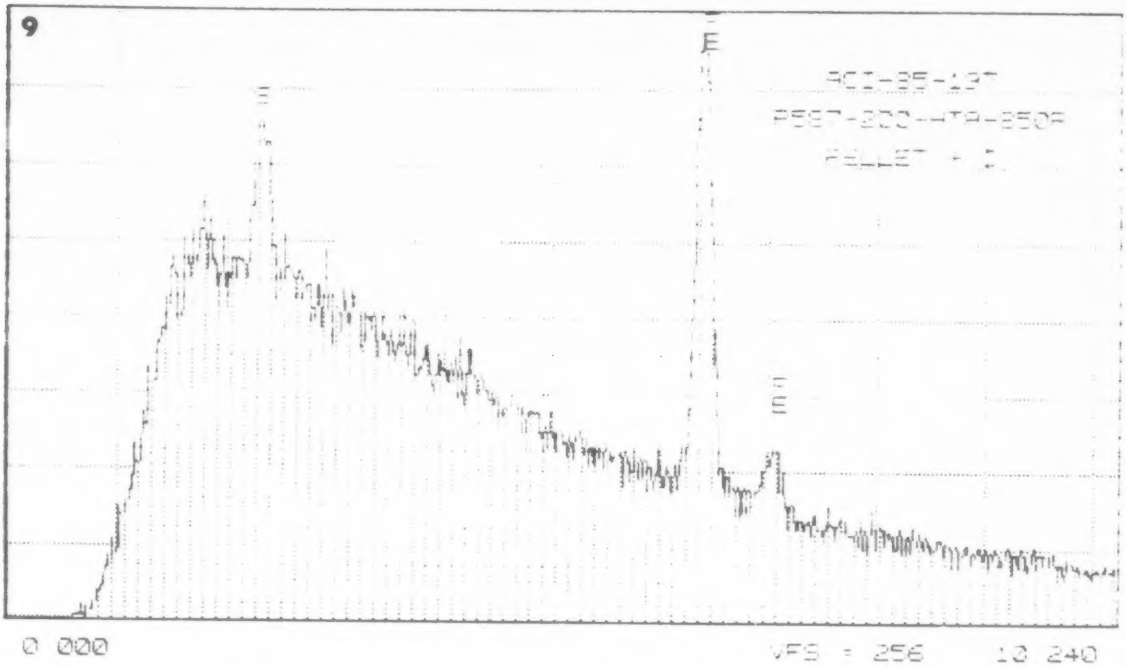


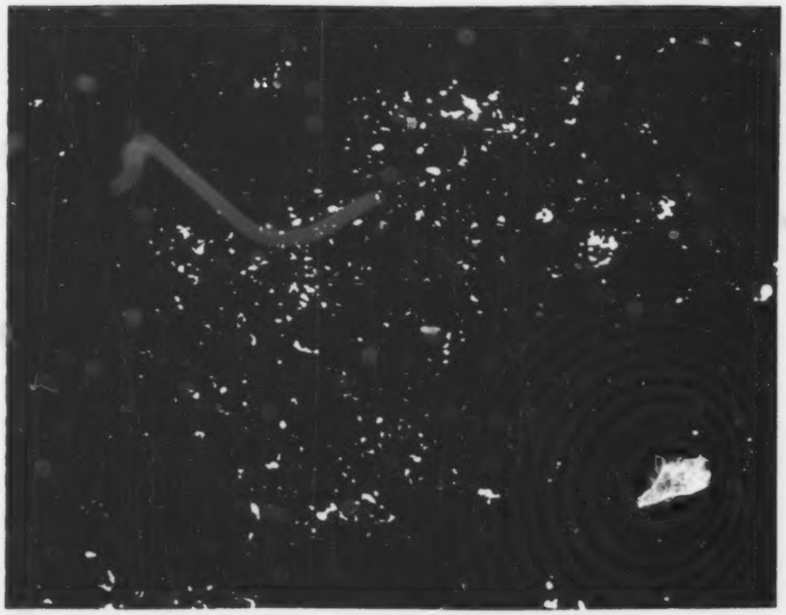
50 MATRIX PHOTO# 0313-03 EDX9

PHOTOMICROGRAPHS: PLATE #8

Western Canadian Coal Ash: -20 mesh coal burned at 850°C, reducing atmosphere

1. 0526-01 35X, BEI. Field of view for leucite-mounted ash from combustion.
2. 0526-04 200X, BEI. Note the friable nature of samples and degree of plucking or vesicular texture.
3. 0526-03 100X, BEI from print #1. Note siderite grain. The bedded mineral texture (on lest) shows possible reaction rim of finer minerals.
4. 0526-02 200X, BEI from print #1. Minerals: calcite, kaolinite.
5. 0527-02 350X, BEI. Minerals present: kaolinite, quartz, apatite.
6. 0526-05 500X, BEI from print #4. Minerals present: quartz (Q), calcite (C), illite (I), barite (?) (grain 2), a rare earch mineral with Si-Ba-Ce (grain 4, bright), apatite (A).
7. 0527-01 500X, BEI, Minerals present include: illite-quartz (I,Q), kaolinite, and Al polishing artifact (X). Illite is high in titanium. B shows Si, Al, S.
8. 0526-06 500X SEI same field as #6.

1



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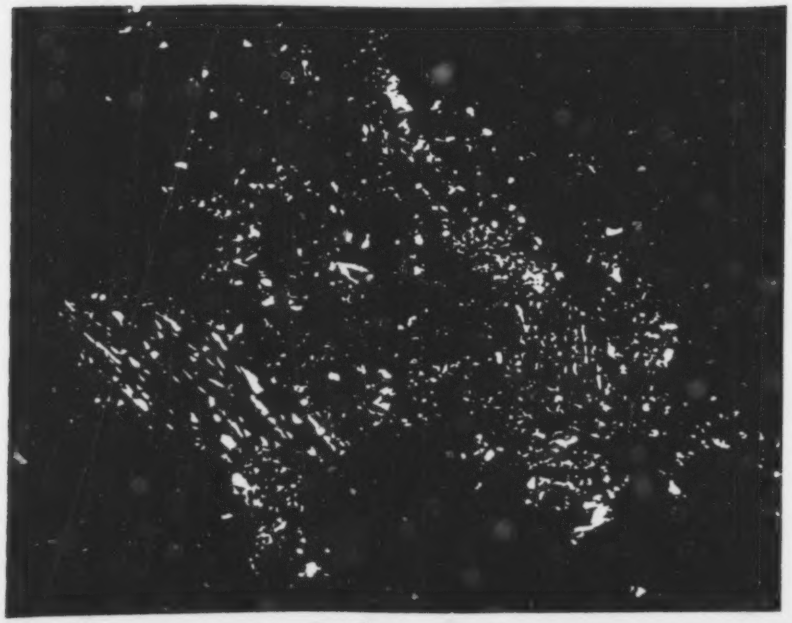

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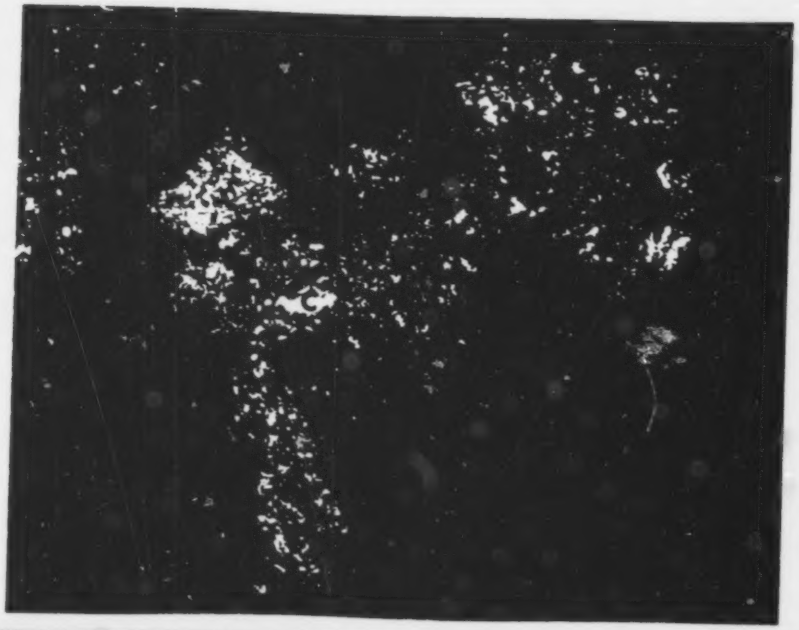

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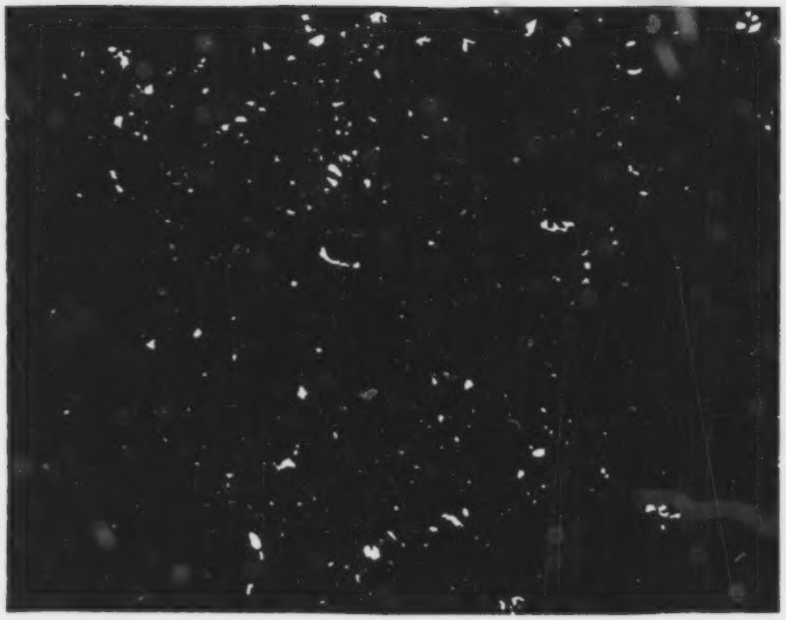

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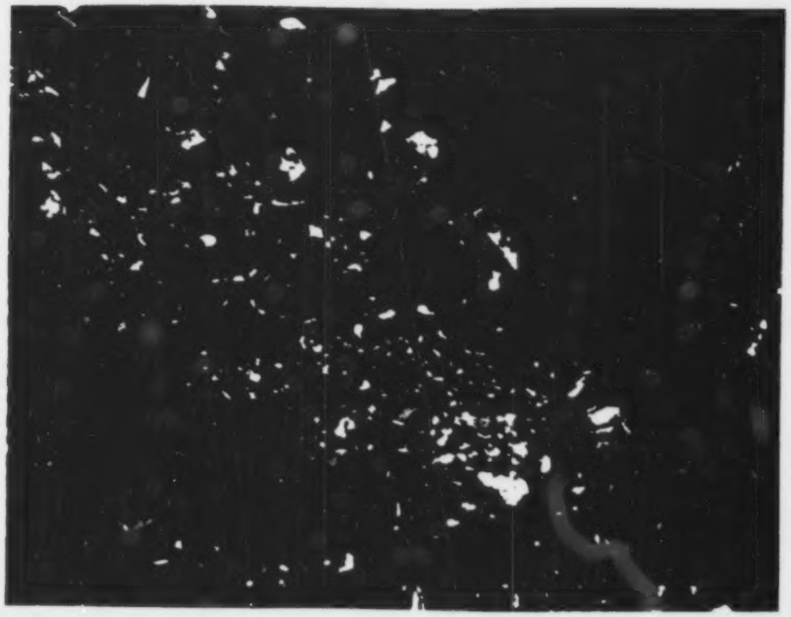

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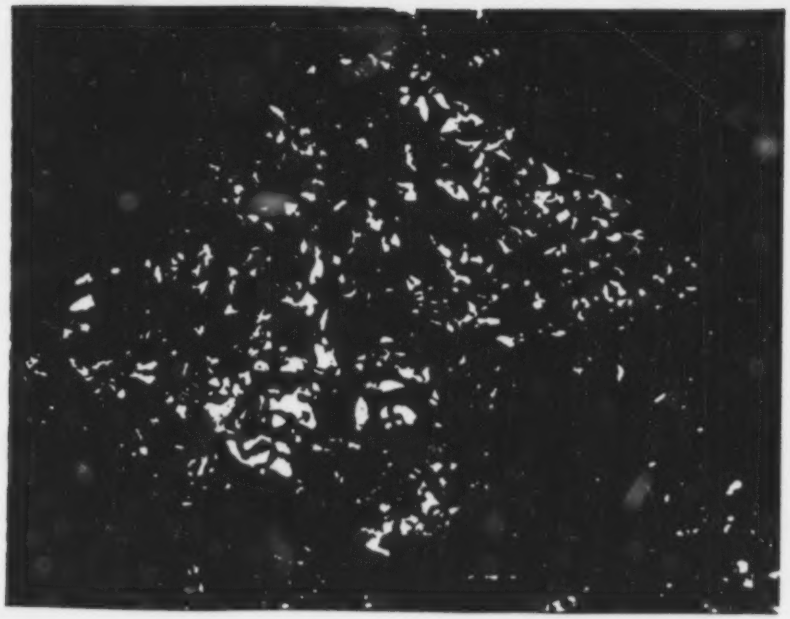

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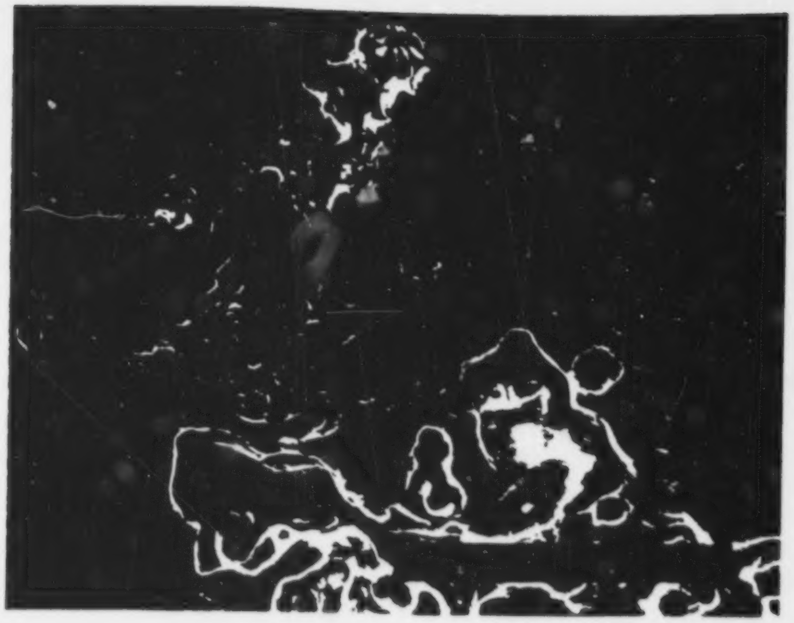

8

EDX SPECTRA: SET #8
Combustion Residue: 850°C
reducing atmosphere

Spectrum: Sample: Western Coal, P587, -20 mesh

1. Calcite

2. Barite with significant Calcium. Silica and aluminium likely from surrounding clay material.

3. Quartz. Note trace of Calcium.

4. Clay mineral with several other elements present. Presence of Calcium and Phosphorous indicates apatite grain may be embedded. Note presence of trace amounts of Cesium, Barium and Strontium.

5. Dominant Calcium and Phosphorous peaks suggest apatite. Aluminium may be polishing remnant. Note presence of Cesium, Barium and Strontium.

6. Remnant coaly (?) material. Note trace Calcium.

7. Illite.

8. Calcium carbonate mineral, presence of iron and magnesium indicates ankerite.

9. Kaolinite

10. Illite with large Titanium peak. Likely an imbedded rutile grain.

11. Coke: Note high sulphur. Associated clays indicated by high silicon and aluminium peaks.

12. Siderite.

?

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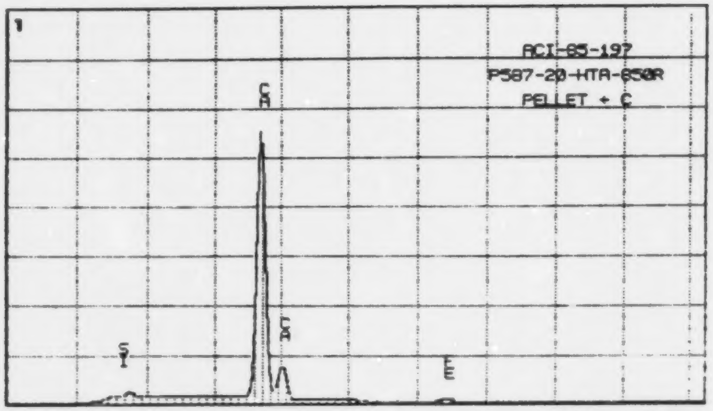

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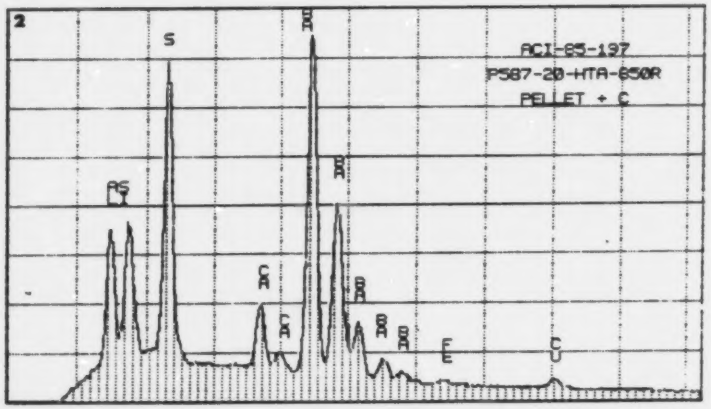

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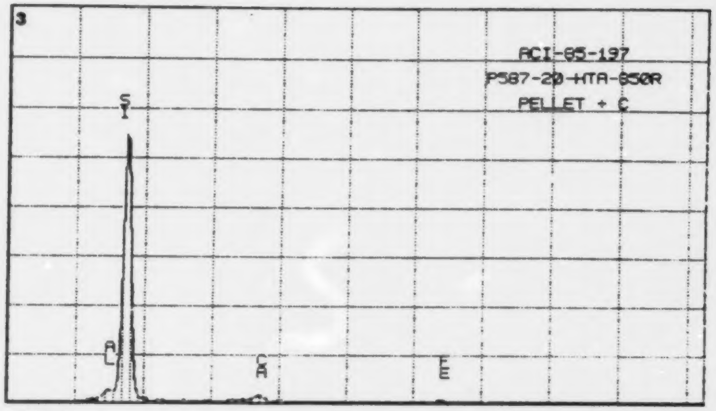

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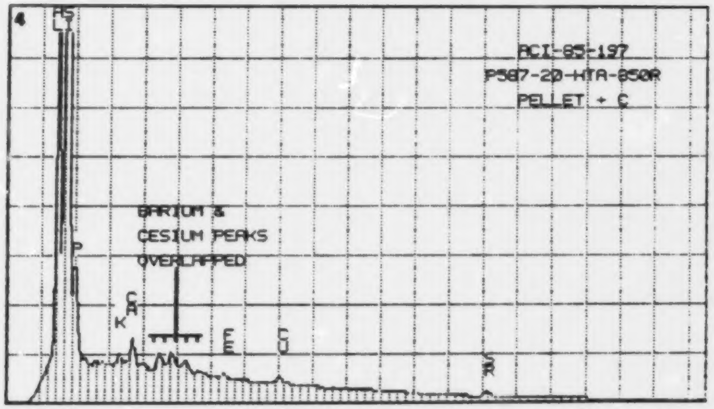

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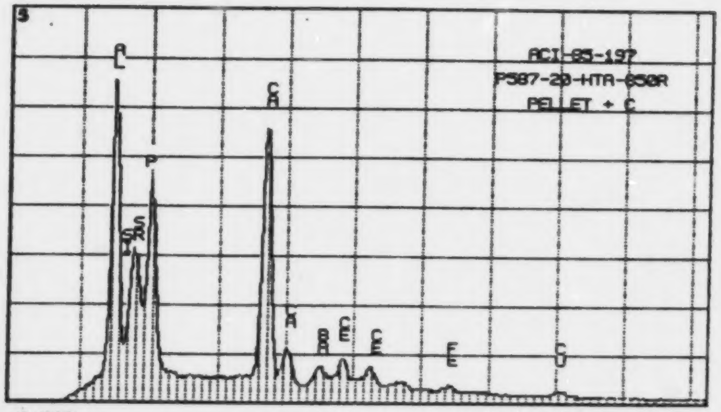

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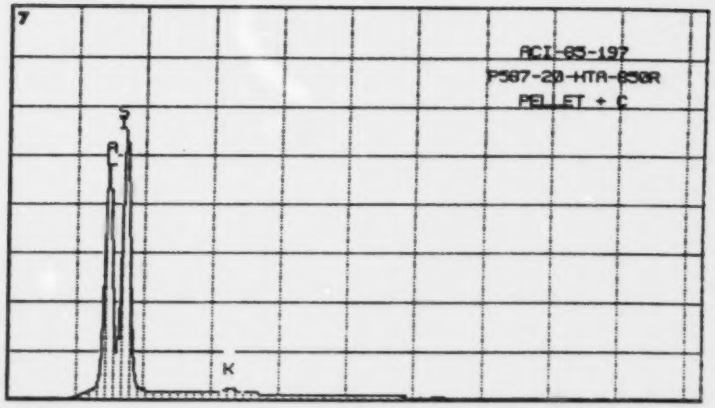

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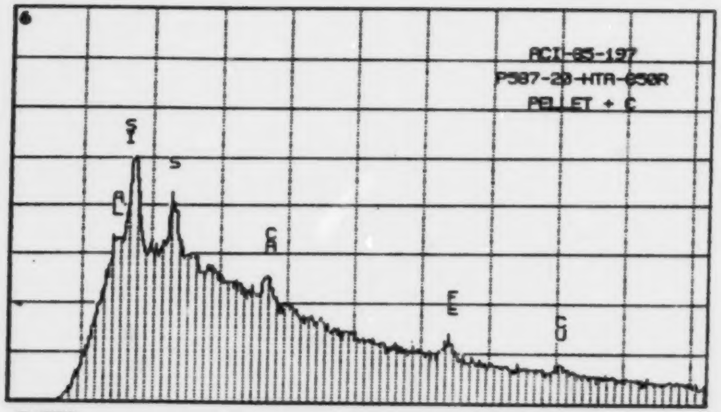

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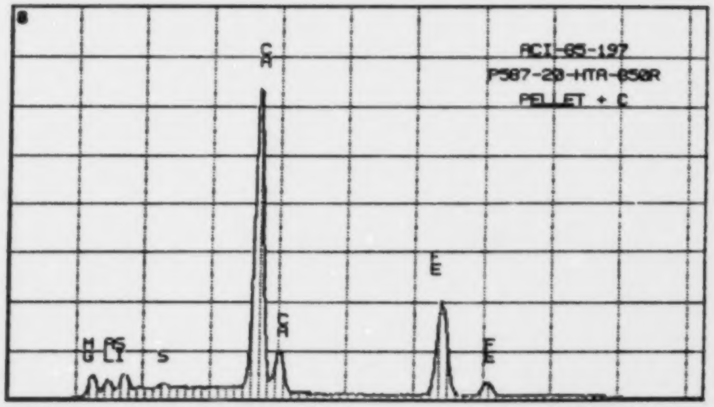

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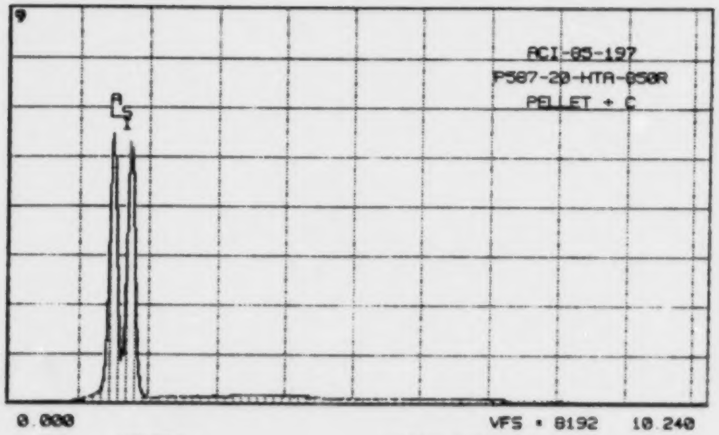

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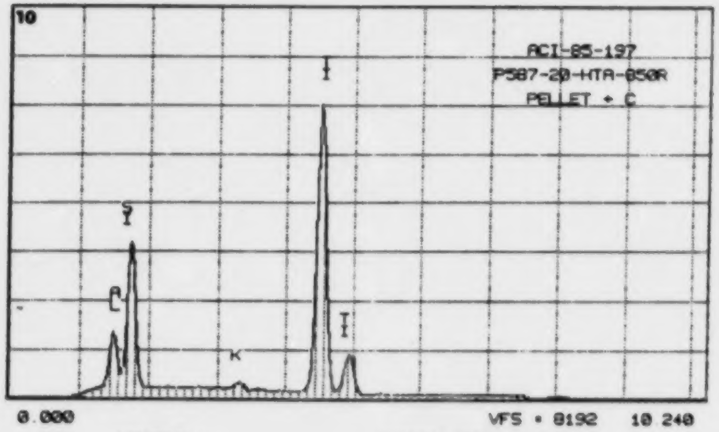

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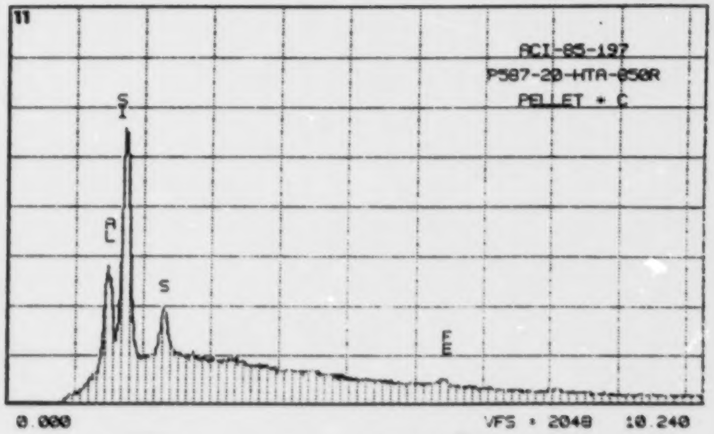

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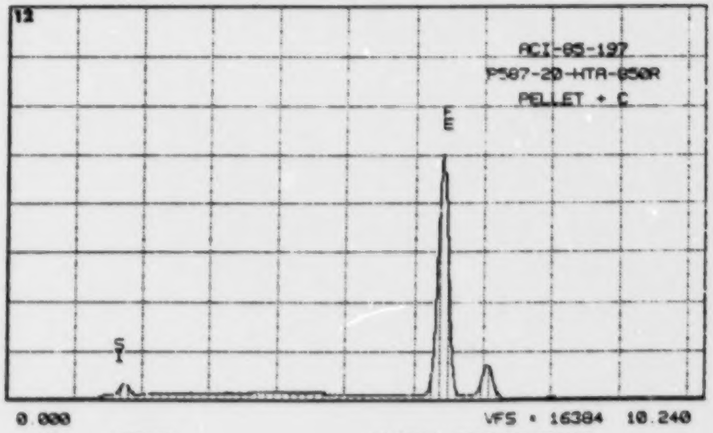
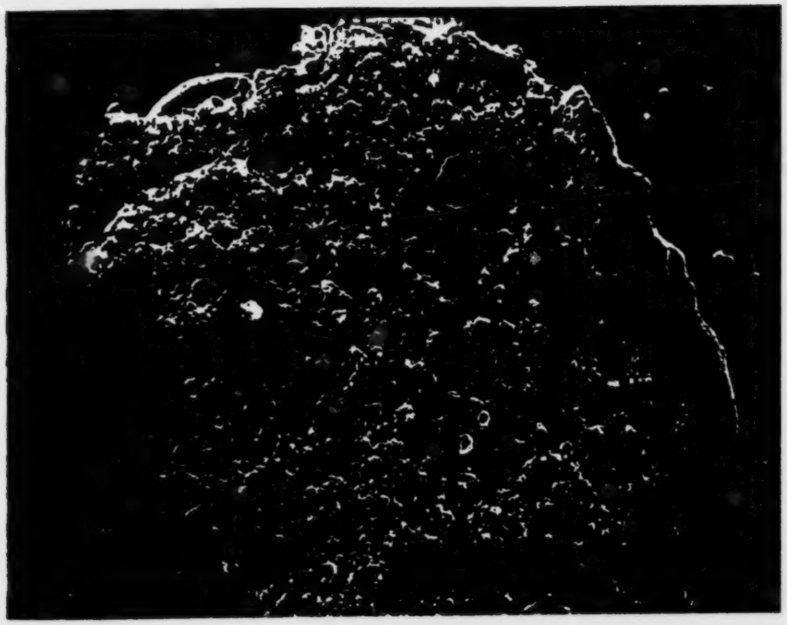


50 MATRIX PHOTO# 0526-03.EDX12

PHOTOMICROGRAPHS: PLATE #9
Combustion Residue
850°C reducing atmosphere

Western Coal: F587, 200 mesh. Combustion residue mounted on carbon stub, carbon coated.

1. 0224-01 35X, SEI, 20 Kv. Low magnification view of residue. Note relief and porous texture.
2. 0221-01 35X, BEI, 20 Kv. Same view with minerals highlighted. Location 20 is carbon point. Location 21 is coke matrix.
3. 0224-02 100X, SEI. Enlarged from photo 1 (0224-01).
4. 0221-02 100X, BEI. Same view. Minerals identified as: illite (I), coke (B), siderite or iron oxide (S).
5. 0224-04 150X, SEI. Enlarged from photo 1 (bottom left).
6. 0224-05 150X, BEI, as above. Minerals identified: kaolinite (K), quartz (Q).
7. 0227-01 1000X, BEI. Enlargement of photo #6 (0224-05) showing vesicular texture in coke. Minerals identified as: rutile (R), iron-rich (S), quartz (Q) and calcite (C).
8. 0304-01 1500X, BEI. Enlargement from photo #3 (0224-02) showing mineral cluster.
9. 0227-02 1500X, SEI, **anosphere**
10. 0304-02 750X, BEI. Enlargement from photo #4 (0221-02).



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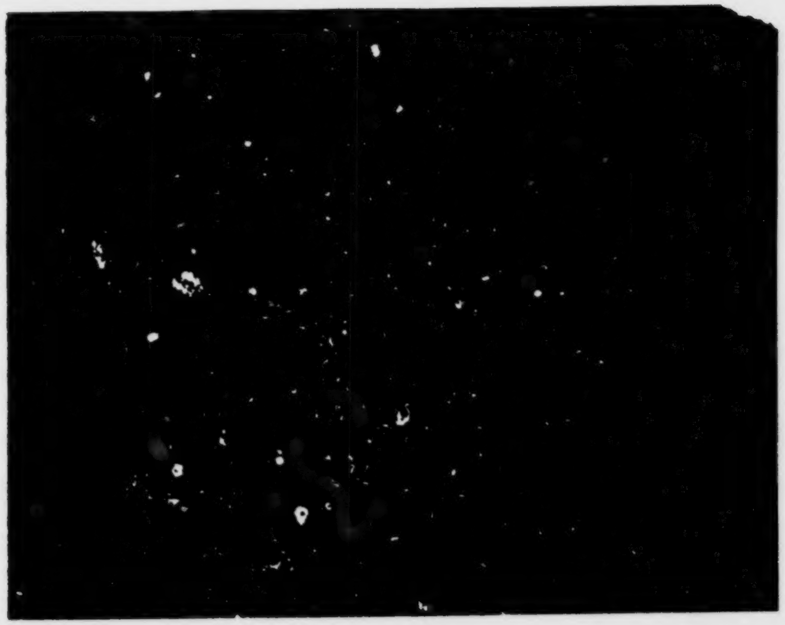

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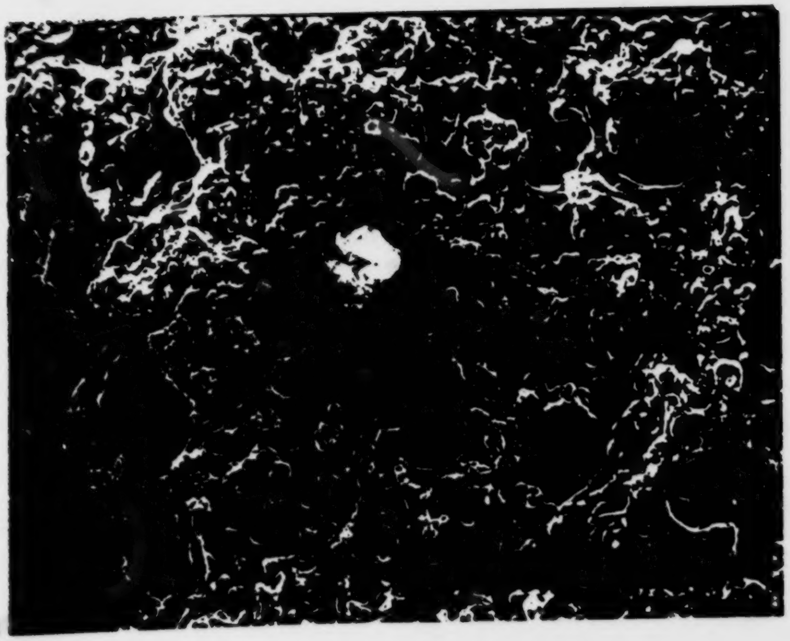

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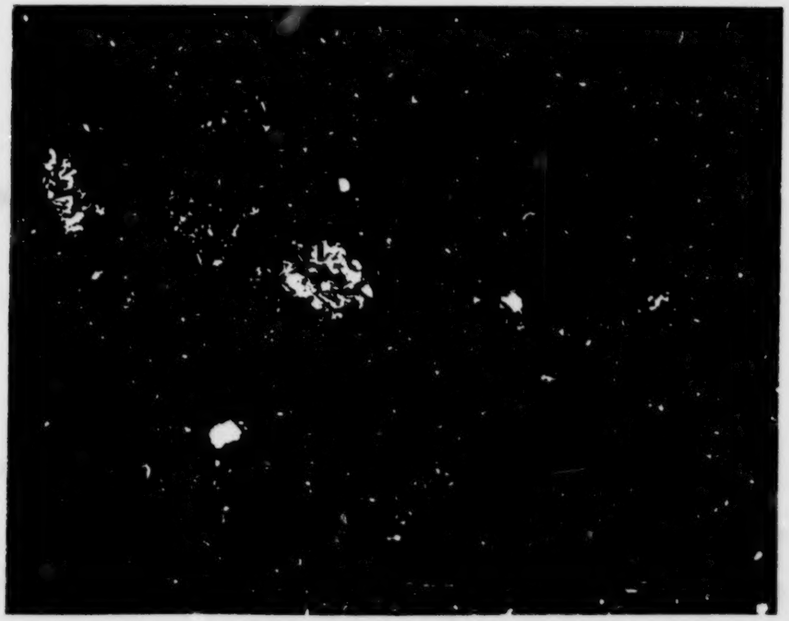

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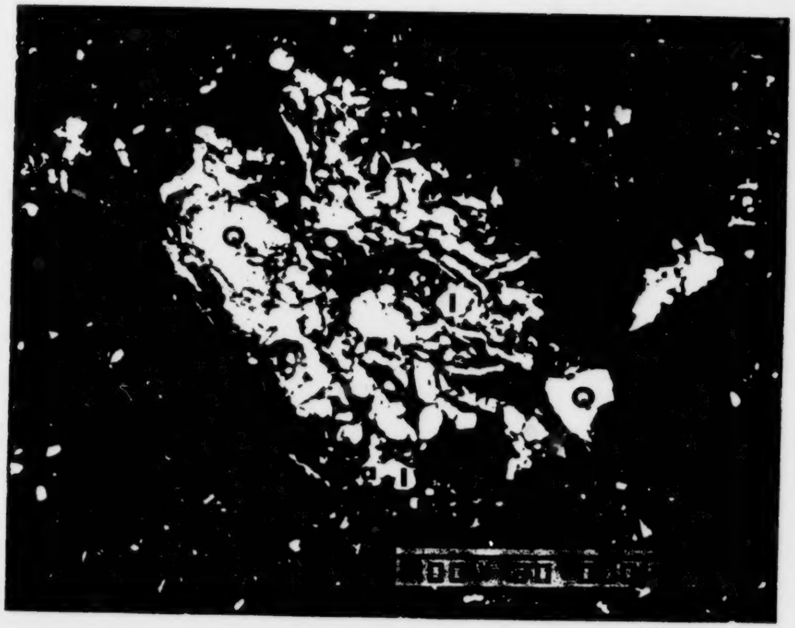

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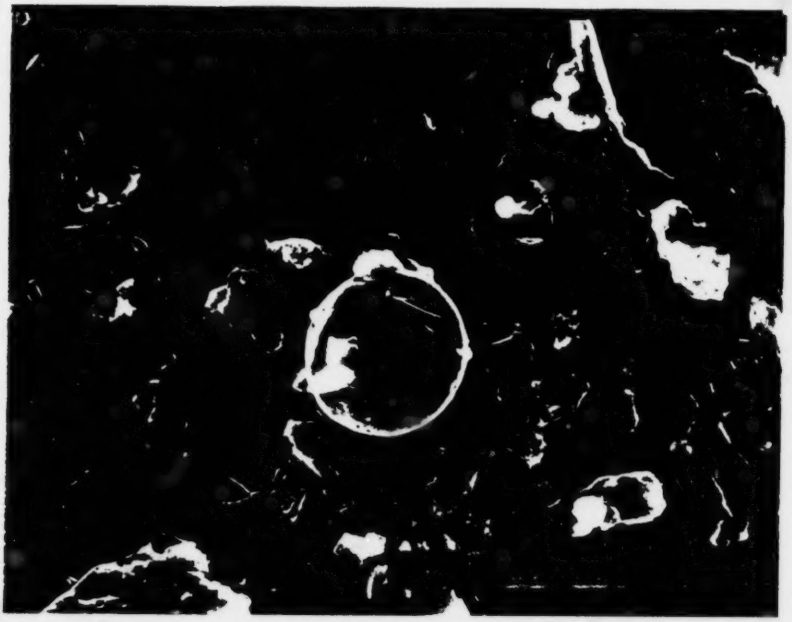

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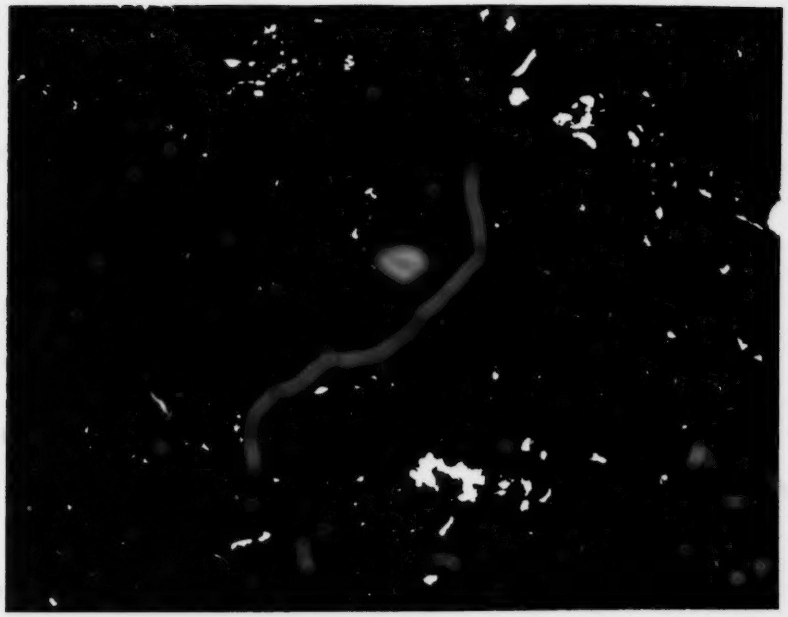

10

EDX SPECTRA: SET #9
Combustion Residue: 850°C
Reducing atmosphere

Spectrum: Sample: Western Coal, P587, -200 mesh

1. Iron oxide or siderite.

2. Illite clay: unaltered.

3. Siderite (with trace calcite?).

4. Unknown: iron silicate?

5. Clay-iron silicate?

6. Coke or remnant coal (B): this spectrum is typical for bituminous coal with high organic sulphur.

7. Quartz.

8. Iron silicate: reaction product?

9. Ore minerals: galena, cassiterite?

10. Kaolinite

11. Iron silicate: reaction with sphalerite?

12. Iron silicate: reaction with rutile or remnant ilmenite.

13. Rutile

14. Quartz

15. Iron oxide or siderite.

16. Ankerite with quartz (?) or reaction product.

17. Cenosphere: silica glass (G).

18. Calcium sulphate (Ca): likely a reaction of dolomite with coal sulphur. Note minor Mg and Fe.

19. Xenotime (X): refractory mineral.

20. Carbon paint on coke.

21. Coke matrix: note high S, Si and Fe. Traces of Ti, Cu and Zn are also indicated.

22. Complex (Ba) of apatite-barite and/or other trace minerals: possibly monazite, strontianite. These minerals are refractory.

ATLANTIC COAL INSTITUTE
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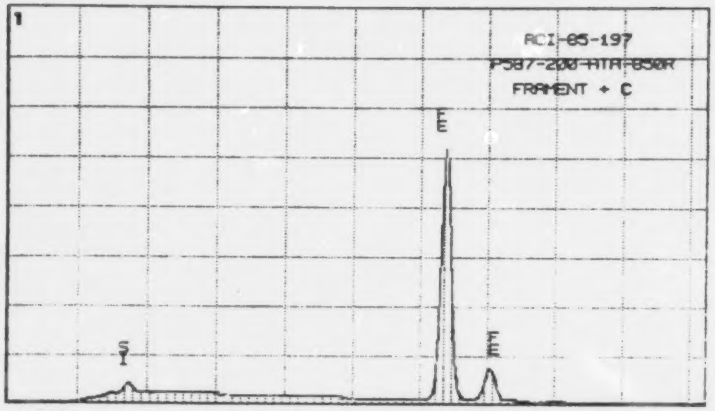
FRI 21-FEB-86 11:54



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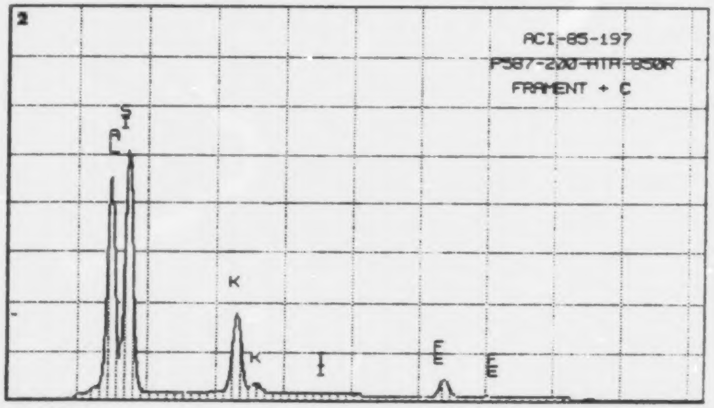
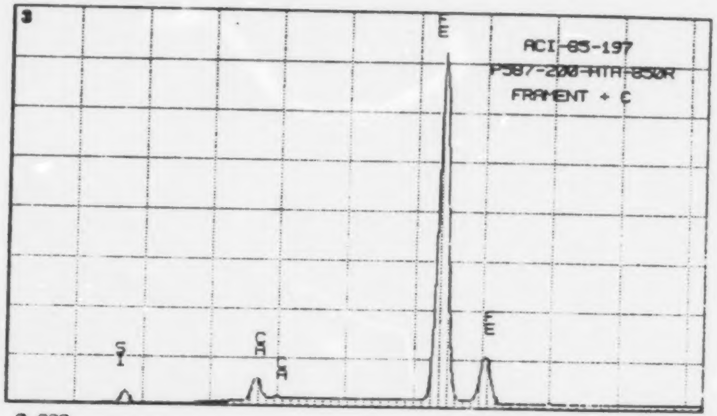
Cursor: 0.000keV = 0
FRI 21-FEB-86 11:58



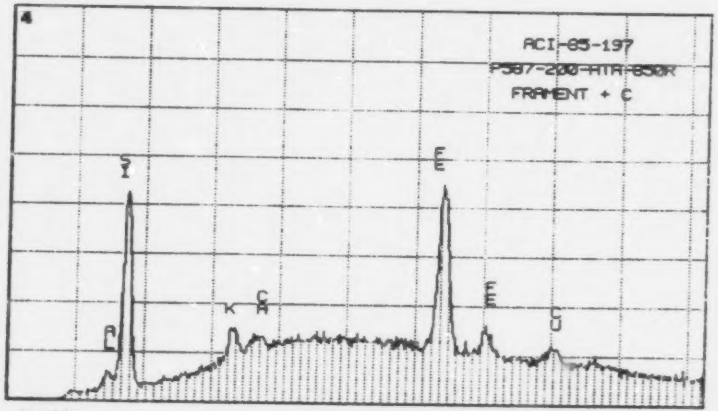
0.000 VFS = 16384 10.240
50 MINERAL: PHOTO# 0221-02.EDX2

ATLANTIC COAL INSTITUTE
Cursor: 0.000keV = 0
FRI 21-FEB-86 12:04



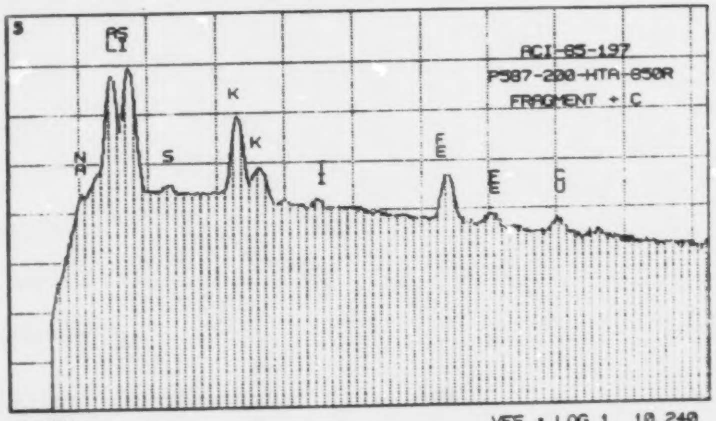
0.000 VFS = 16384 10.240
MINERAL: PHOTO# 0221-02.EDX3 50

ATLANTIC COAL INSTITUTE
Cursor: 0.000keV = 0
FRI 21-FEB-86 12:17



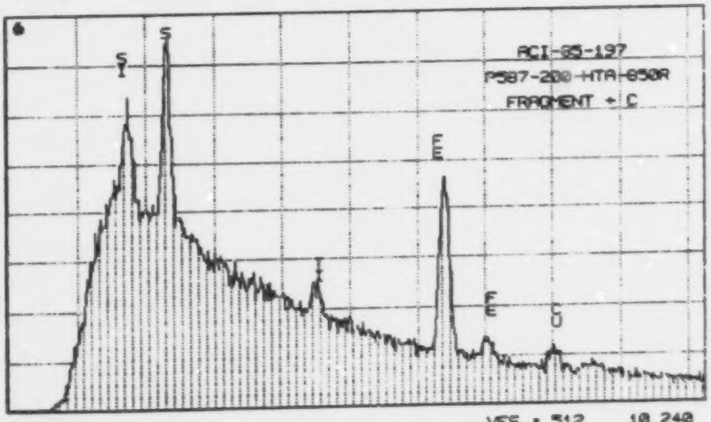
0.000 VFS = 1024 10.240
50 MINERAL: PHOTO# 0221-02.EDX4

ATLANTIC COAL INSTITUTE MON 24-FEB-86 11:36
Cursor: 0.000keV = 0



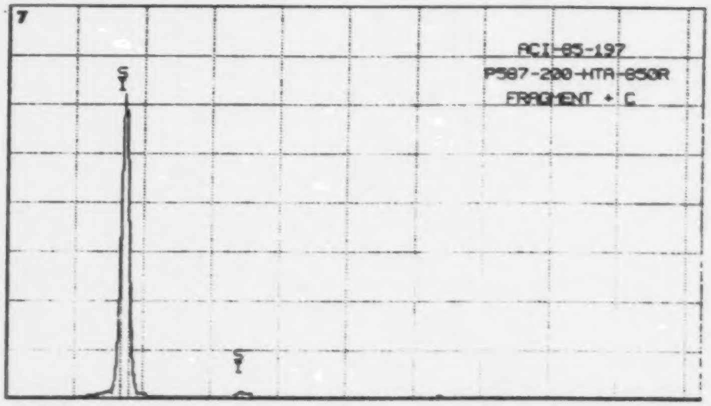
MINERAL: PHOTO# 0221-02.EDX5

ATLANTIC COAL INSTITUTE MON 24-FEB-86 11:47
Cursor: 0.000keV = 0



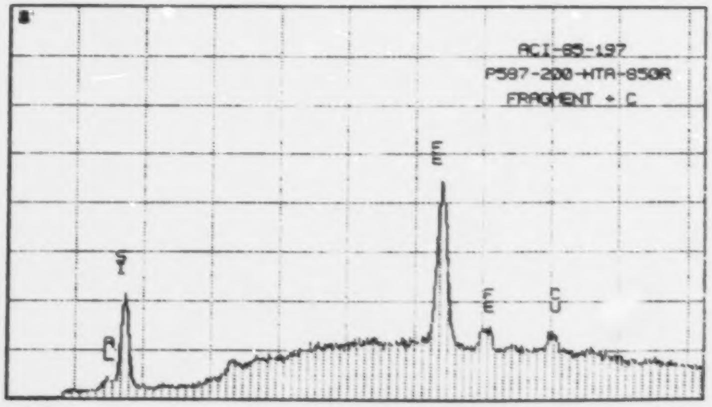
MINERAL: PHOTO# 0221-02.EDX6

ATLANTIC COAL INSTITUTE MON 24-FEB-86 13:14
Cursor: 0.000keV = 0



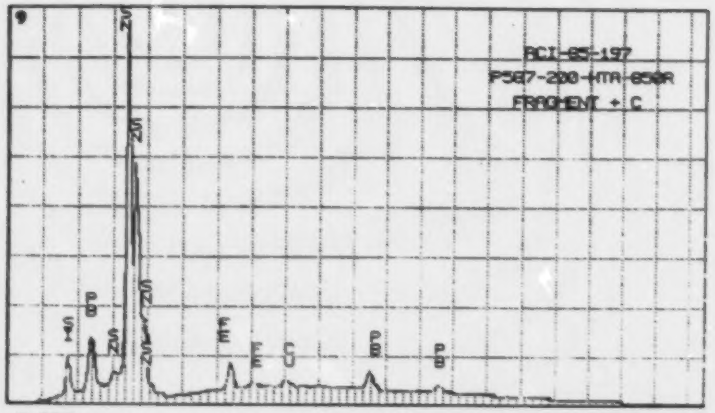
MINERAL: PHOTO# 0224-03.EDX7

ATLANTIC COAL INSTITUTE MON 24-FEB-86 13:45
Cursor: 0.000keV = 0



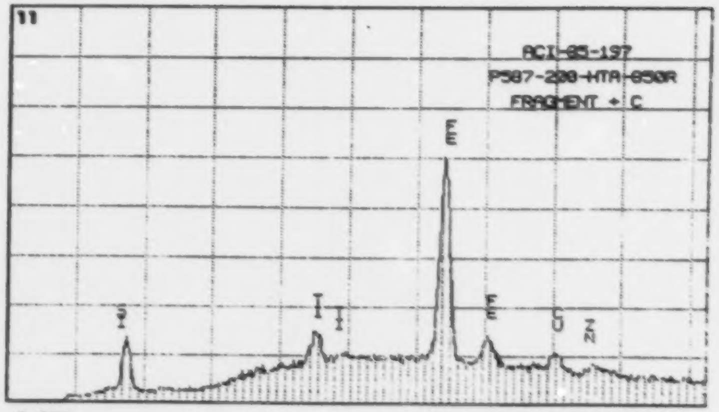
MINERAL: PHOTO# 0224-05.EDX8

ATLANTIC COAL INSTITUTE MON 24-FEB-86 13:51
Cursor: 0.000keV = 0



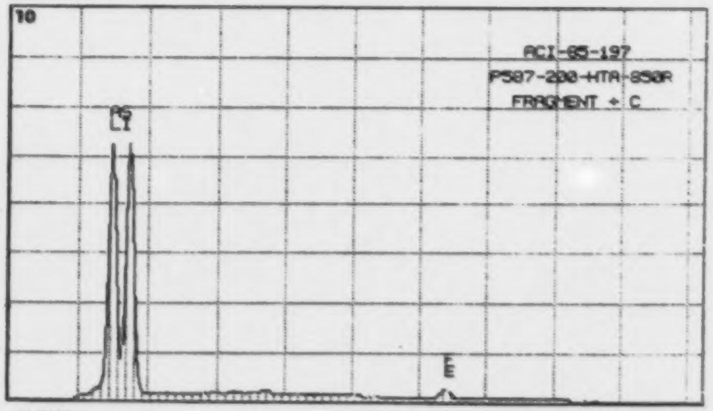
0.000 VFS = 8192 20 480
50 MINERAL: PHOTO# 0224-05.EDX9

ATLANTIC COAL INSTITUTE TUE 04-MAR-86 09:13
Cursor: 0.000keV = 0



0.000 VFS = 1024 10.240
50 MINERAL: PHOTO# 0227-01.EDX11

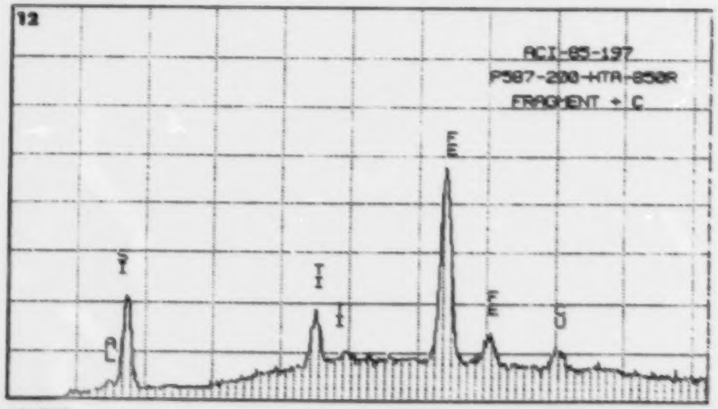
ATLANTIC COAL INSTITUTE MON 24-FEB-86 13:58
Cursor: 0.000keV = 0



0.000 VFS = 16384 10.240
MINERAL: PHOTO# 0224-03.EDX10 50

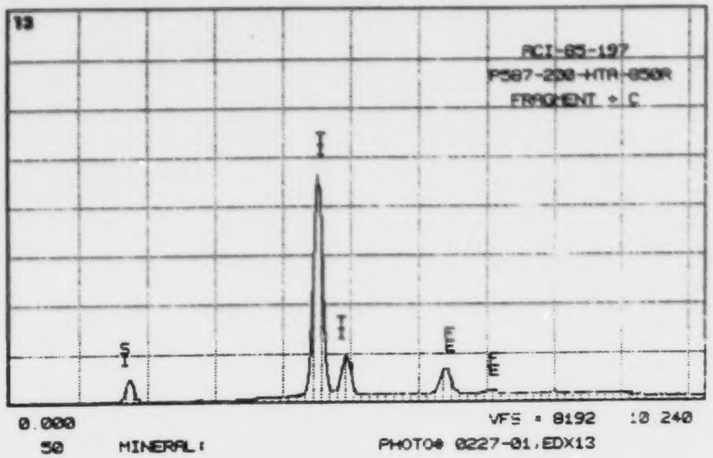
TN FLEXTRAN [12-H]

ATLANTIC COAL INSTITUTE TUE 04-MAR-86 09:15
Cursor: 0.000keV = 0

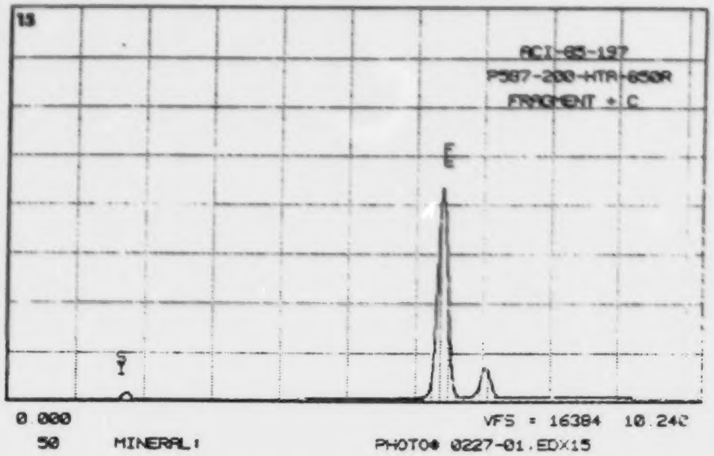


0.000 VFS = 1024 10.240
MINERAL: PHOTO# 0227-01.EDX12 50

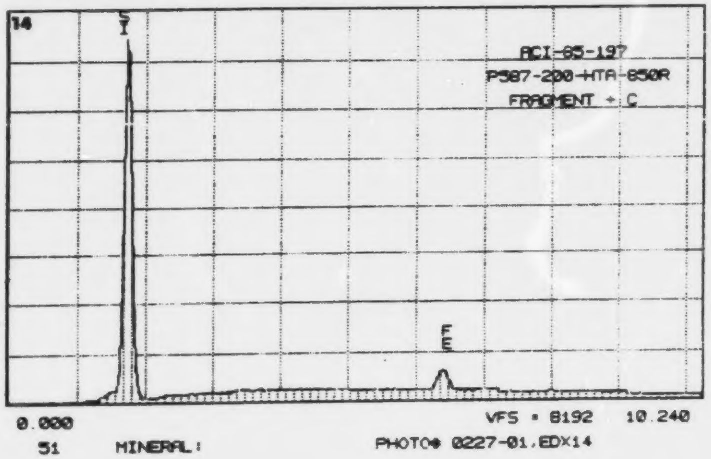
ATLANTIC COAL INSTITUTE FRI 28-FEB-86 10:51
Cursor: 0.000keV = 0



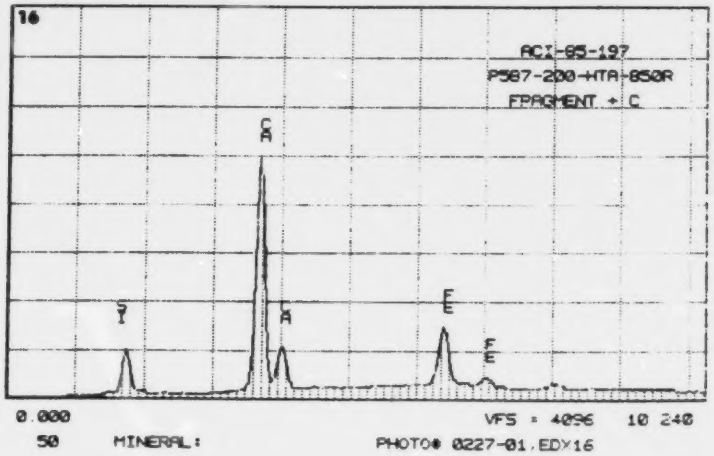
ATLANTIC COAL INSTITUTE FRI 28-FEB-86 10:56
Cursor: 0.000keV = 0



ATLANTIC COAL INSTITUTE FRI 28-FEB-86 10:53
Cursor: 0.000keV = 0

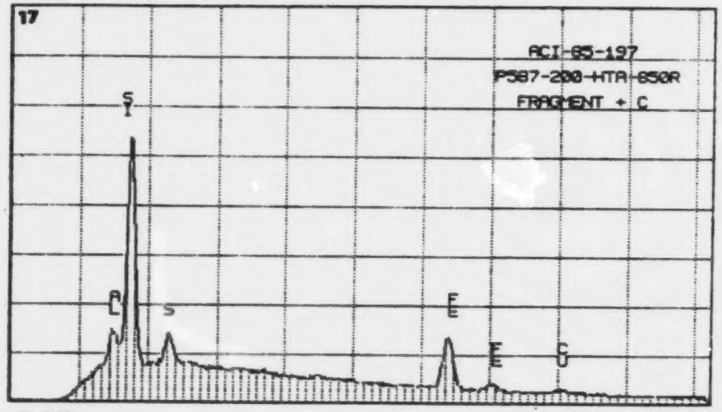


ATLANTIC COAL INSTITUTE FRI 28-FEB-86 10:58
Cursor: 0.000keV = 0



N= +125

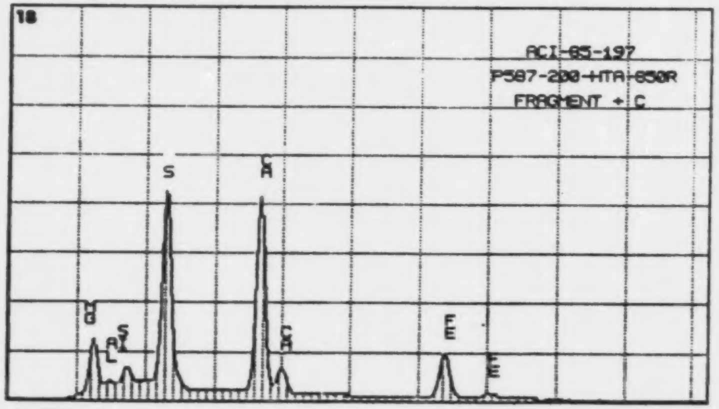
ATLANTIC COAL INSTITUTE TUE 04-MAR-86 10:12
Cursor: 0.000keV = 0



0.000 VFS = 4096 10.240
50 MINERAL: PHOTO# 0227-02.EDX17

N= +126

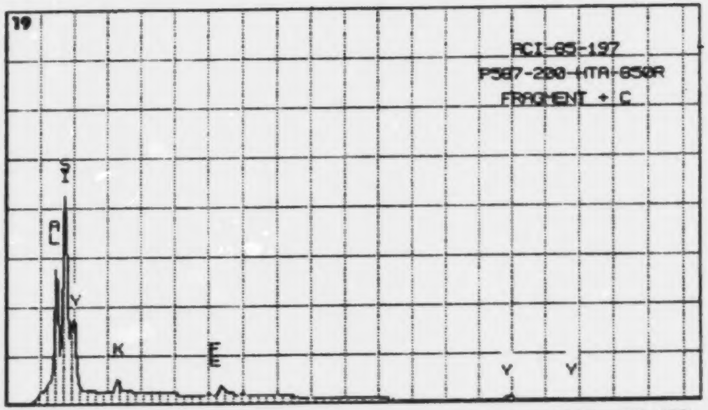
ATLANTIC COAL INSTITUTE TUE 04-MAR-86 10:14
Cursor: 0.000keV = 0



0.000 VFS = 32768 10.240
50 MINERAL: PHOTO# 0304-01.EDX18

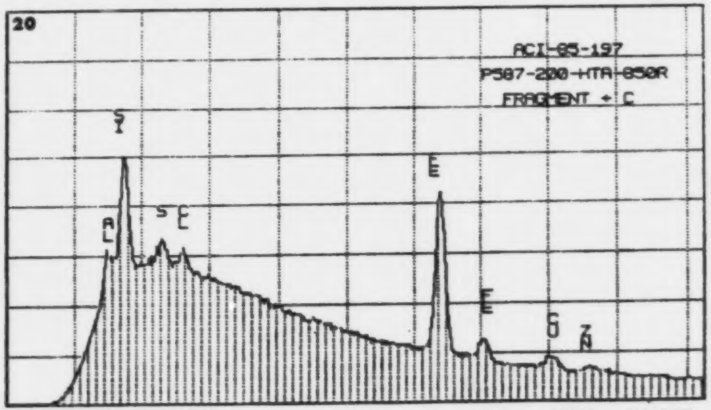
N= +127

ATLANTIC COAL INSTITUTE WED 05-MAR-86 08:41
Cursor: 0.000keV = 0



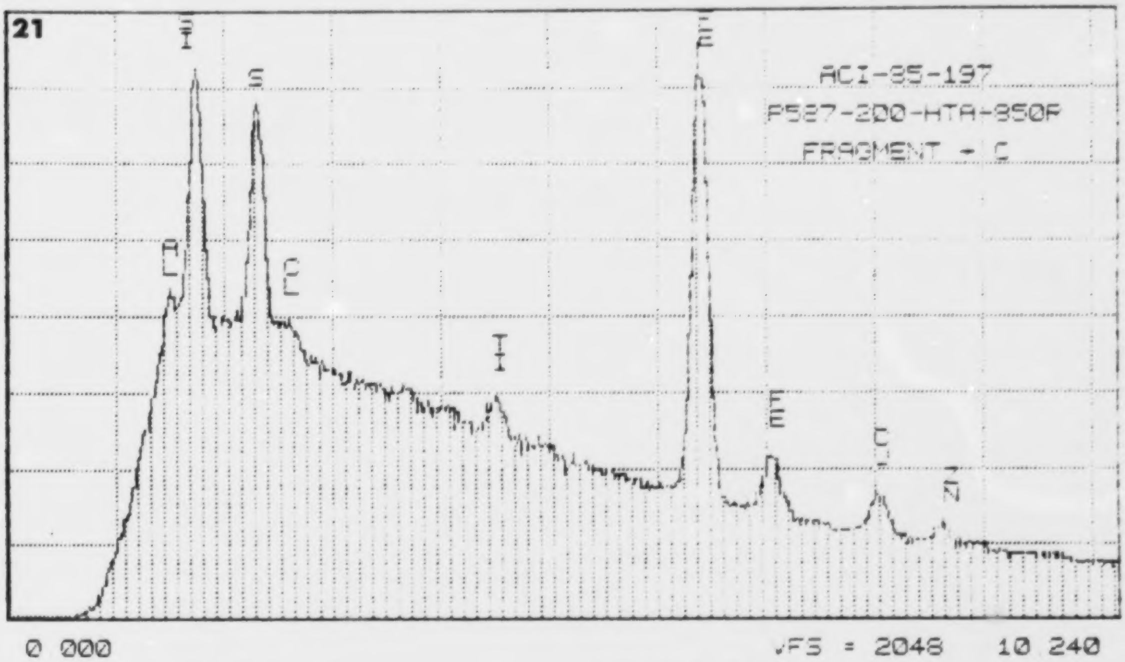
0.000 VFS = 16384 20.480
50 MINERAL: * 25kV * PHOTO# 0304-01.EDX19

ATLANTIC COAL INSTITUTE WED 05-MAR-86 08:44
Cursor: 0.000keV = 0



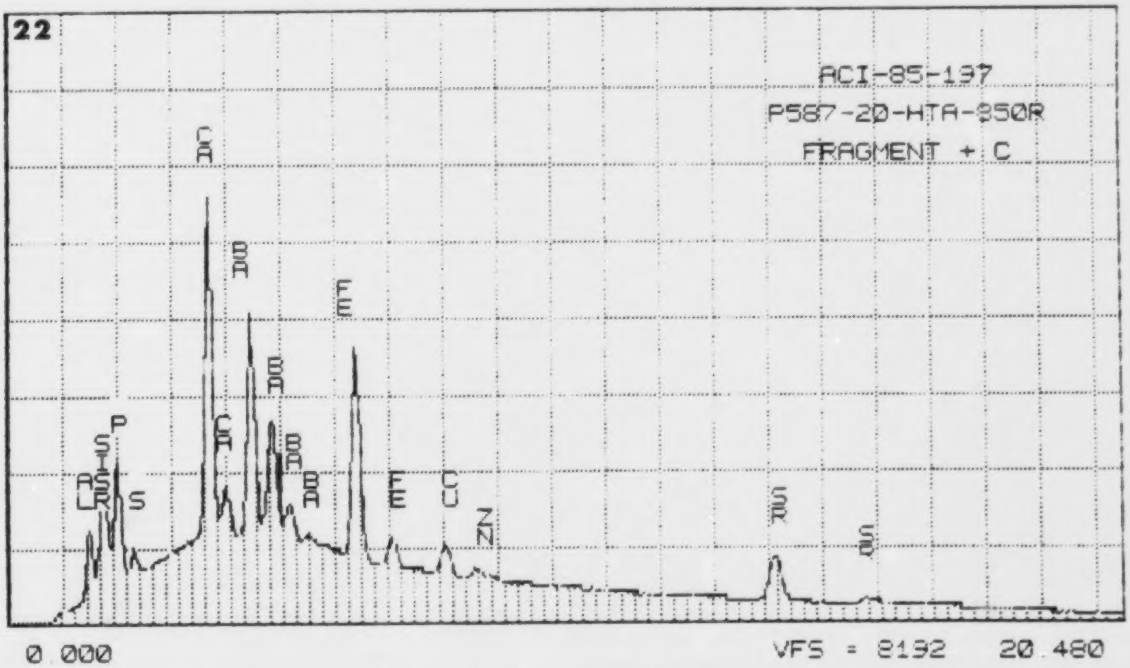
0.000 VFS = 4096 10.240
CARBON PRINT PHOTO# 0304-01.EDX20 306

ATLANTIC COAL INSTITUTE WED 05-MAR-86 08:33
Cursor: 0.000keV = 0



306 MATRIX PHOTO# 0221-01,EDX21

ATLANTIC COAL INSTITUTE WED 05-MAR-86 16:12
Cursor: 0.000keV = 0



200 MINERAL: * 25 KV * PHOTO# 0304-02,EDX22

```
PRC: REPORT             FILE NO.?16
                        DRIVE NO.?
                        DRIVE NO.?2                 MAGNIFICATION=                  50
                        LABEL: 50720050R50          GUARD REGION=               12.000 microns
SUMMARY OF RESULTS                                  MINIMUM PARTICLE SIZE=       5.000 microns
                                                    MAXIMUM PARTICLE SIZE=      30.000 microns
LABEL: 05-197-P507-20-HTA-050-R  50X (5-30)         LOW SHAPE FACTOR=            1.000
NUMBER OF FRAMES              1                     HIGH SHAPE FACTOR=           7.000
NUMBER OF PARTICLES         537
MAGNIFICATION                50
FIELD WIDTH=            1799.56 um
OFF PARTICLE SPACING=      4.03 um
ON PARTICLE SPACING=       0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE          NAME                    AVE.DIA.            MAX       MAX/MIN     AREA       PERIMETER
                                      MICRONS             MICRONS               uM^2       MICRONS
  0  ALL TYPES               9.28E+00 +-  4.25E+00    1.63E+01    3.00E+00  9.145E+01   4.912E+01
  2  KAOLINITE               9.70E+00 +-  4.00E+00    1.69E+01    3.45E+00  1.007E+02   4.940E+01
  3  ILLITE                  8.61E+00 +-  2.63E+00    1.84E+01    8.30E+00  7.667E+01   4.996E+01
  4  QUARTZ                  9.74E+00 +-  4.60E+00    1.74E+01    3.77E+00  1.014E+02   5.141E+01
  6  CALCITE                 1.44E+01 +-  5.70E+00    3.00E+01    3.64E+00  1.863E+02   8.463E+01
 15  APATITE                 7.47E+00 +-  0.00E+00    9.66E+00    1.69E+00  4.634E+01   2.768E+01
 22  POLISH                  8.82E+00 +-  3.20E+00    1.52E+01    3.77E+00  7.815E+01   4.527E+01
 23  ILLITE + Ti             7.47E+00 +-  0.00E+00    1.84E+01    5.13E+00  5.605E+01   4.548E+01
 62  NON-INT                 8.56E+00 +-  3.00E+00    1.49E+01    3.75E+00  7.346E+01   4.538E+01
 63  UNKNOWN                 9.79E+00 +-  5.27E+00    1.72E+01    4.01E+00  1.078E+02   5.334E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                   NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                         537    100.00       1.51
  2  KAOLINITE                          63     11.73       0.19
  3  ILLITE                             10      1.86       0.02
  4  QUARTZ                             62     11.54       0.19
  6  CALCITE                             5      0.93       0.02
 15  APATITE                             1      0.18       0.00
 22  POLISH                            132     24.58       0.31
 23  ILLITE + Ti                         2      0.37       0.00
 62  NON-INT                           115     21.41       0.26
 63  UNKNOWN                           147     27.37       0.48
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       85  15.8 [********
     7.00       75  13.9 [*******
     8.00      122  22.7 [************
     9.00       45   8.3 [*****
    10.00       44   8.1 [*****
    11.00       59  10.9 [******
    12.00       15   2.7 [**
    13.00       13   2.4 [**
    14.00       17   3.1 [**
    15.00       17   3.1 [**
    16.00        5   0.9 [*
    17.00        8   1.4 [*
    18.00        4   0.7 [*
    19.00        6   1.1 [*
    20.00       10   1.8 [*
    21.00        1   0.1 [*
    22.00        3   0.5 [*
    23.00        0   0.0 [
    24.00        2   0.3 [*
    25.00        1   0.1 [*
    26.00        0   0.0 [
    27.00        1   0.1 [*
    28.00        0   0.0 [
    29.00        0   0.0 [
    30.00        4   0.7 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        7  11.1 [******
     7.00        7  11.1 [******
     8.00       19  30.1 [****************
     9.00        5   7.9 [****
    10.00        3   4.7 [***
    11.00        9  14.2 [********
    12.00        3   4.7 [***
    13.00        1   1.5 [*
    14.00        2   3.1 [**
    15.00        1   1.5 [*
    16.00        0   0.0 [
    17.00        0   0.0 [
    18.00        1   1.5 [*
    19.00        0   0.0 [
    20.00        2   3.1 [**
    21.00        0   0.0 [
    22.00        1   1.5 [*
    23.00        0   0.0 [
    24.00        1   1.5 [*
    25.00        0   0.0 [
    26.00        0   0.0 [
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        0   0.0 [
    30.00        1   1.5 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  10.0 [******
     7.00       1  10.0 [******
     8.00       5  50.0 [**************************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       1  10.0 [******
    12.00       0   0.0 [
    13.00       1  10.0 [******
    14.00       1  10.0 [******

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      10  16.1 [*********
     7.00      12  19.3 [**********
     8.00       8  12.9 [*******
     9.00       1   1.6 [*
    10.00       8  12.9 [*******
    11.00       6   9.6 [*****
    12.00       2   3.2 [**
    13.00       3   4.8 [***
    14.00       4   6.4 [****
    15.00       2   3.2 [**
    16.00       1   1.6 [*
    17.00       1   1.6 [*
    18.00       0   0.0 [
    19.00       1   1.6 [*
    20.00       2   3.2 [**
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   1.6 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       1  20.0 [***********
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       1  20.0 [***********
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       1  20.0 [***********
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1  20.0 [***********
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       1  20.0 [***********

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      26  19.6 [**********
     7.00      10   7.5 [****
     8.00      35  26.5 [**************
     9.00      14  10.6 [******
    10.00       8   6.0 [****
    11.00      16  12.1 [*******
    12.00       5   3.7 [**
    13.00       3   2.2 [**
    14.00       4   3.0 [**
    15.00       4   3.0 [**
    16.00       2   1.5 [*
    17.00       1   0.7 [*
    18.00       1   0.7 [*
    19.00       0   0.0 [
    20.00       3   2.2 [**
    21.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       2 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      19  16.5 [*********
     7.00      20  17.3 [*********
     8.00      22  19.1 [**********
     9.00      15  13.0 [*******
    10.00      14  12.1 [*******
    11.00       8   6.9 [****
    12.00       4   3.4 [**
    13.00       2   1.7 [*
    14.00       2   1.7 [*
    15.00       3   2.6 [**
    16.00       1   0.8 [*
    17.00       2   1.7 [*
    18.00       0   0.0 [
    19.00       1   0.8 [*
    20.00       2   1.7 [*
    21.00       0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      22  14.9 [********
     7.00      25  17.0 [*********
     8.00      29  19.7 [**********
     9.00      10   6.8 [****
    10.00      11   7.4 [****
    11.00      18  12.2 [*******
    12.00       1   0.6 [*
    13.00       3   2.0 [**
    14.00       4   2.7 [**
    15.00       6   4.0 [***
    16.00       1   0.6 [*
    17.00       4   2.7 [**
    18.00       2   1.3 [*
    19.00       3   2.0 [**
    20.00       1   0.6 [*
    21.00       1   0.6 [*
    22.00       1   0.6 [*
    23.00       0   0.0 [
    24.00       1   0.6 [*
    25.00       1   0.6 [*
    26.00       0   0.0 [
    27.00       1   0.6 [*
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       2   1.3 [*
```

```
PRC: REP

                              FILE NO.?19
SUMMARY OF RESULTS                           MAGNIFICATION=              500
                                             GUARD REGION=             4.000 microns
LABEL: 85-197-P587-20-HTA-850-R      (5-30)  MINIMUM PARTICLE SIZE=    0.500 microns
NUMBER OF FRAMES              1              MAXIMUM PARTICLE SIZE=    7.500 microns
NUMBER OF PARTICLES         660              LOW SHAPE FACTOR=         1.000
MAGNIFICATION               500              HIGH SHAPE FACTOR=        7.000
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um            THRESHOLDS:  LOWER=  65  UPPER= 255
ON PARTICLE SPACING=       0.04 um
FIELD AREA=            3.23E+04 um^2
TYPE        NAME
                              AVE.DIA.              MAX        MAX/MIN      AREA       PERIMETER
                              MICRONS               MICRONS                 uM^2       MICRONS
  0  ALL TYPES           1.80E+00 +-  1.11E+00   3.21E+00   3.35E+00  3.912E+00  8.620E+00
  2  KAOLINITE           2.14E+00 +-  1.15E+00   3.91E+00   3.57E+00  5.223E+00  1.057E+01
  3  ILLITE              1.15E+00 +-  5.83E-01   2.00E+00   2.75E+00  1.435E+00  4.965E+00
  4  QUARTZ              2.15E+00 +-  1.19E+00   3.72E+00   2.87E+00  5.149E+00  9.565E+00
  5  SIDERITE            5.77E+00 +-  3.75E+00   9.07E+00   2.77E+00  3.457E+01  2.412E+01
  6  CALCITE             3.55E+00 +-  0.00E+00   5.49E+00   2.08E+00  1.041E+01  1.291E+01
 15  APATITE             3.77E+00 +-  0.00E+00   4.52E+00   1.55E+00  1.098E+01  1.278E+01
 22  POLISH              1.55E+00 +-  9.76E-01   2.72E+00   3.45E+00  2.859E+00  7.472E+00
 23  ILLITE + Ti         1.38E+00 +-  4.03E-01   2.28E+00   2.55E+00  1.690E+00  5.712E+00
 62  NON-INT             1.44E+00 +-  7.32E-01   2.49E+00   3.33E+00  2.282E+00  6.864E+00
 63  UNKNOWN             1.48E+00 +-  9.08E-01   2.71E+00   3.53E+00  2.696E+00  7.334E+00

PARTICLE COUNT SUMMARY
TYPE         NAME
                              NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                  660    100.00       7.97
  2  KAOLINITE                  186     28.18       2.99
  3  ILLITE                      15      2.27       0.06
  4  QUARTZ                     117     17.72       1.86
  5  SIDERITE                     2      0.30       0.21
  6  CALCITE                      1      0.15       0.03
 15  APATITE                      1      0.15       0.03
 22  POLISH                     131     19.84       1.15
 23  ILLITE + Ti                  2      0.30       0.01
 62  NON-INT                     84     12.72       0.59
 63  UNKNOWN                    121     18.33       1.00

PRC: HIS
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      94  14.2 [********
     1.00      71  10.7 [******
     1.25      91  13.7 [*******
     1.50      76  11.5 [******
     1.75      58   8.7 [*****
     2.00      48   7.2 [****
     2.25      36   5.4 [***
     2.50      31   4.6 [***
     2.75      30   4.5 [***
     3.00      32   4.8 [***
     3.25      25   3.7 [**
     3.50      19   2.8 [**
     3.75      15   2.2 [**
     4.00      11   1.6 [*
     4.25       3   0.4 [*
     4.50       5   0.7 [*
     4.75       2   0.3 [*
     5.00       2   0.3 [*
     5.25       2   0.3 [*
     5.50       2   0.3 [*
     5.75       1   0.1 [*
     6.00       3   0.4 [*
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       1   0.1 [*
     7.50       2   0.3 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      13   6.9 [****
     1.00      16   8.6 [*****
     1.25      21  11.2 [******
     1.50      15   8.0 [*****
     1.75      19  10.2 [******
     2.00      17   9.1 [*****
     2.25       9   4.8 [***
     2.50      13   6.9 [****
     2.75      13   6.9 [****
     3.00       8   4.3 [***
     3.25       9   4.8 [***
     3.50      10   5.3 [***
     3.75       7   3.7 [**
     4.00       6   3.2 [**
     4.25       1   0.5 [*
     4.50       1   0.5 [*
     4.75       1   0.5 [*
     5.00       1   0.5 [*
     5.25       2   1.0 [*
     5.50       1   0.5 [*
     5.75       1   0.5 [*
     6.00       2   1.0 [*
     6.25       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       4  26.6 [**************
     1.00       4  26.6 [**************
     1.25       2  13.3 [*******
     1.50       2  13.3 [*******
     1.75       1   6.6 [****
     2.00       1   6.6 [****
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       1   6.6 [****
     3.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      10   8.5 [*****
     1.00      10   8.5 [*****
     1.25      10   8.5 [*****
     1.50       7   5.9 [***
     1.75      11   9.4 [*****
     2.00      12  10.2 [******
     2.25      10   8.5 [*****
     2.50       6   5.1 [***
     2.75       8   6.8 [****
     3.00      11   9.4 [*****
     3.25       7   5.9 [***
     3.50       5   4.2 [***
     3.75       2   1.7 [*
     4.00       1   0.8 [*
     4.25       2   1.7 [*
     4.50       0   0.0 [
     4.75       1   0.8 [*
     5.00       1   0.8 [*
     5.25       0   0.0 [
     5.50       1   0.8 [*
     5.75       0   0.0 [
     6.00       1   0.8 [*
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       1   0.8 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      0   0.0 [
     2.25      0   0.0 [
     2.50      0   0.0 [
     2.75      0   0.0 [
     3.00      0   0.0 [
     3.25      1  50.0 [**************************
     3.50      0   0.0 [
     3.75      0   0.0 [
     4.00      0   0.0 [
     4.25      0   0.0 [
     4.50      0   0.0 [
     4.75      0   0.0 [
     5.00      0   0.0 [
     5.25      0   0.0 [
     5.50      0   0.0 [
     5.75      0   0.0 [
     6.00      0   0.0 [
     6.25      0   0.0 [
     6.50      0   0.0 [
     6.75      0   0.0 [
     7.00      0   0.0 [
     7.25      0   0.0 [
     7.50      1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      0   0.0 [
     2.25      0   0.0 [
     2.50      0   0.0 [
     2.75      0   0.0 [
     3.00      0   0.0 [
     3.25      0   0.0 [
     3.50      0   0.0 [
     3.75      1 100.0 [*********************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        0   0.0 [
     1.00        0   0.0 [
     1.25        0   0.0 [
     1.50        0   0.0 [
     1.75        0   0.0 [
     2.00        0   0.0 [
     2.25        0   0.0 [
     2.50        0   0.0 [
     2.75        0   0.0 [
     3.00        0   0.0 [
     3.25        0   0.0 [
     3.50        0   0.0 [
     3.75        0   0.0 [
     4.00        1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75       23  17.5 [*********
     1.00       17  12.9 [*******
     1.25       26  19.8 [**********
     1.50       19  14.5 [********
     1.75        8   6.1 [****
     2.00        8   6.1 [****
     2.25        3   2.2 [**
     2.50        5   3.8 [**
     2.75        4   3.0 [**
     3.00        8   6.1 [****
     3.25        3   2.2 [**
     3.50        2   1.5 [*
     3.75        1   0.7 [*
     4.00        2   1.5 [*
     4.25        0   0.0 [
     4.50        1   0.7 [*
     4.75        0   0.0 [
     5.00        0   0.0 [
     5.25        0   0.0 [
     5.50        0   0.0 [
     5.75        0   0.0 [
     6.00        0   0.0 [
     6.25        0   0.0 [
     6.50        0   0.0 [
     6.75        0   0.0 [
     7.00        0   0.0 [
     7.25        1   0.7 [*
     7.50        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       0   0.0 [
      1.00       0   0.0 [
      1.25       1  50.0 [**************************
      1.50       0   0.0 [
      1.75       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75      17  20.2 [***********
      1.00       9  10.7 [******
      1.25      13  15.4 [********
      1.50      12  14.2 [********
      1.75      10  11.9 [******
      2.00       6   7.1 [****
      2.25       7   8.3 [*****
      2.50       4   4.7 [***
      2.75       1   1.1 [*
      3.00       2   2.3 [**
      3.25       0   0.0 [
      3.50       2   2.3 [**
      3.75       0   0.0 [
      4.00       0   0.0 [
      4.25       0   0.0 [
      4.50       1   1.1 [*
      4.75       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75      27  22.3 [************
      1.00      15  12.3 [*******
      1.25      18  14.8 [********
      1.50      21  17.3 [*********
      1.75       8   6.6 [****
      2.00       4   3.3 [**
      2.25       7   5.7 [***
      2.50       3   2.4 [**
      2.75       3   2.4 [**
      3.00       3   2.4 [**
      3.25       5   4.1 [***
      3.50       0   0.0 [
      3.75       4   3.3 [**
      4.00       1   0.8 [*
      4.25       0   0.0 [
      4.50       2   1.6 [*
      4.75       0   0.0 [
PRC: REP
             FILE NO.?1
                                                      THRESHOLDS:  LOWER=  65  UPPER= 255
SUMMARY OF RESULTS
                                                    MAGNIFICATION=                 50
LABEL: 85-197-P507-200-1100R  50X                   GUARD REGION=              15.000 microns
NUMBER OF FRAMES                  1                 MINIMUM PARTICLE SIZE=      5.000 microns
NUMBER OF PARTICLES             506                 MAXIMUM PARTICLE SIZE=     30.000 microns
MAGNIFICATION                    50                 LOW SHAPE FACTOR=           1.000
FIELD WIDTH=               1799.56 um               HIGH SHAPE FACTOR=          7.000
OFF PARTICLE SPACING=         4.03 um
ON PARTICLE SPACING=          0.43 um
FIELD AREA=             3.23E+06 um^2
TYPE        NAME
                                 AVE.DIA.                MAX        MAX/MIN      AREA       PERIMETER
                                 MICRONS               MICRONS                   uM^2       MICRONS
  0  ALL TYPES           1.08E+01 +-  4.95E+00      1.88E+01     3.66E+00   1.223E+02  5.555E+01
  2  KAOLINITE           1.06E+01 +-  4.23E+00      1.85E+01     3.28E+00   1.144E+02  5.401E+01
  3  ILLITE              9.57E+00 +-  5.11E+00      1.63E+01     3.92E+00   1.044E+02  4.868E+01
  4  QUARTZ              1.06E+01 +-  6.54E+00      1.77E+01     3.48E+00   1.282E+02  5.405E+01
  5  SIDERITE            1.97E+01 +-  6.21E-01      2.57E+01     2.59E+00   3.178E+02  8.239E+01
 16  MONAZITE            9.22E+00 +-  0.00E+00      2.15E+01     6.12E+00   9.095E+01  5.844E+01
 22  ILLITE + Ti         7.47E+00 +-  3.10E+00      1.27E+01     3.83E+00   6.025E+01  3.933E+01
 23  ZIRCON              7.03E+00 +-  0.00E+00      1.49E+01     1.69E+01   5.610E+01  4.218E+01
 24  POLISH              1.08E+01 +-  4.52E+00      1.85E+01     3.04E+00   1.186E+02  5.420E+01
 62  NON-INT             1.06E+01 +-  4.69E+00      1.91E+01     4.09E+00   1.159E+02  5.706E+01
 63  UNKNOWN             1.10E+01 +-  5.62E+00      2.00E+01     4.51E+00   1.368E+02  5.933E+01
PARTICLE COUNT SUMMARY
TYPE        NAME
                              NUMBER     #(%)      T.AREA(%)
  0  ALL TYPES                  506     100.00        1.91
  2  KAOLINITE                   71      14.03        0.25
  3  ILLITE                      19       3.75        0.06
  4  QUARTZ                      30       5.92        0.11
  5  SIDERITE                     2       0.39        0.01
 16  MONAZITE                     1       0.19        0.00
 22  ILLITE + Ti                  2       0.39        0.00
 23  ZIRCON                       1       0.19        0.00
 24  POLISH                     191      37.74        0.69
 62  NON-INT                     66      13.04        0.23
 63  UNKNOWN                    122      24.11        0.51

PRC: HIS
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       56  11.0 [******
     7.00       50   9.8 [*****
     8.00       69  13.6 [*******
     9.00       51  10.0 [******
    10.00       44   8.6 [*****
    11.00       50   9.8 [*****
    12.00       37   7.3 [****
    13.00       23   4.5 [***
    14.00       20   3.9 [**
    15.00       26   5.1 [***
    16.00       11   2.1 [**
    17.00        9   1.7 [*
    18.00       14   2.7 [**
    19.00       11   2.1 [**
    20.00        9   1.7 [*
    21.00        7   1.3 [*
    22.00        5   0.9 [*
    23.00        1   0.1 [*
    24.00        4   0.7 [*
    25.00        2   0.3 [*
    26.00        3   0.5 [*
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        1   0.1 [*
    30.00        3   0.5 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        3   4.2 [***
     7.00        9  12.6 [*******
     8.00       14  19.7 [**********
     9.00        8  11.2 [******
    10.00        6   8.4 [*****
    11.00        7   9.8 [*****
    12.00        5   7.0 [****
    13.00        2   2.8 [**
    14.00        2   2.8 [**
    15.00        2   2.8 [**
    16.00        2   2.8 [**
    17.00        1   1.4 [*
    18.00        4   5.6 [***
    19.00        1   1.4 [*
    20.00        0   0.0 [
    21.00        4   5.6 [***
    22.00        1   1.4 [*
    23.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       5  26.3 [**************
     7.00       2  10.5 [******
     8.00       3  15.7 [********
     9.00       0   0.0 [
    10.00       2  10.5 [******
    11.00       3  15.7 [********
    12.00       0   0.0 [
    13.00       1   5.2 [***
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       2  10.5 [******
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       1   5.2 [***
    26.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       9  30.0 [****************
     7.00       3  10.0 [******
     8.00       2   6.6 [****
     9.00       3  10.0 [******
    10.00       3  10.0 [******
    11.00       2   6.6 [****
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       1   3.3 [**
    16.00       2   6.6 [****
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1   3.3 [**
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       2   6.6 [****
    25.00       0   0.0 [
    26.00       2   6.6 [****
    27.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00      0   0.0 [
      2.00      0   0.0 [
      3.00      0   0.0 [
      4.00      0   0.0 [
      5.00      0   0.0 [
      6.00      0   0.0 [
      7.00      0   0.0 [
      8.00      0   0.0 [
      9.00      0   0.0 [
     10.00      0   0.0 [
     11.00      0   0.0 [
     12.00      0   0.0 [
     13.00      0   0.0 [
     14.00      0   0.0 [
     15.00      0   0.0 [
     16.00      0   0.0 [
     17.00      0   0.0 [
     18.00      0   0.0 [
     19.00      0   0.0 [
     20.00      1  50.0 [*************************
     21.00      1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00      0   0.0 [
      2.00      0   0.0 [
      3.00      0   0.0 [
      4.00      0   0.0 [
      5.00      0   0.0 [
      6.00      0   0.0 [
      7.00      0   0.0 [
      8.00      0   0.0 [
      9.00      0   0.0 [
     10.00      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00      0   0.0 [
      2.00      0   0.0 [
      3.00      0   0.0 [
      4.00      0   0.0 [
      5.00      0   0.0 [
      6.00      1  50.0 [*************************
      7.00      0   0.0 [
      8.00      0   0.0 [
      9.00      0   0.0 [
     10.00      1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00      0   0.0 [
      2.00      0   0.0 [
      3.00      0   0.0 [
      4.00      0   0.0 [
      5.00      0   0.0 [
      6.00      0   0.0 [
      7.00      0   0.0 [
      8.00      1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00      0   0.0 [
     2.00      0   0.0 [
     3.00      0   0.0 [
     4.00      0   0.0 [
     5.00      0   0.0 [
     6.00     15   7.8 [****
     7.00     18   9.4 [*****
     8.00     23  12.0 [*******
     9.00     18   9.4 [*****
    10.00     18   9.4 [*****
    11.00     22  11.5 [******
    12.00     20  10.4 [******
    13.00     11   5.7 [***
    14.00      9   4.7 [***
    15.00     14   7.3 [****
    16.00      3   1.5 [*
    17.00      2   1.0 [*
    18.00      3   1.5 [*
    19.00      6   3.1 [**
    20.00      3   1.5 [*
    21.00      1   0.5 [*
    22.00      1   0.5 [*
    23.00      1   0.5 [*
    24.00      0   0.0 [
    25.00      1   0.5 [*
    26.00      1   0.5 [*
    27.00      0   0.0 [
    28.00      0   0.0 [
    29.00      0   0.0 [
    30.00      1   0.5 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00      0   0.0 [
     2.00      0   0.0 [
     3.00      0   0.0 [
     4.00      0   0.0 [
     5.00      0   0.0 [
     6.00      7  10.6 [******
     7.00      7  10.6 [******
     8.00     11  16.6 [*********
     9.00     10  15.1 [********
    10.00      4   6.0 [****
    11.00      5   7.5 [****
    12.00      1   1.5 [*
    13.00      4   6.0 [****
    14.00      1   1.5 [*
    15.00      3   4.5 [***
    16.00      1   1.5 [*
    17.00      3   4.5 [***
    18.00      3   4.5 [***
    19.00      0   0.0 [
    20.00      3   4.5 [***
    21.00      0   0.0 [
    22.00      2   3.0 [**
    23.00      0   0.0 [
    24.00      1   1.5 [*
    25.00      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00      15  12.2 [*******
      7.00      11   9.0 [*****
      8.00      15  12.2 [*******
      9.00      12   9.8 [*****
     10.00       9   7.3 [****
     11.00      11   9.0 [*****
     12.00      11   9.0 [*****
     13.00       5   4.0 [***
     14.00       8   6.5 [****
     15.00       6   4.9 [***
     16.00       3   2.4 [**
     17.00       1   0.8 [*
     18.00       4   3.2 [**
     19.00       3   2.4 [**
     20.00       2   1.6 [*
     21.00       1   0.8 [*
     22.00       1   0.8 [*
     23.00       0   0.0 [
     24.00       1   0.8 [*
     25.00       0   0.0 [
     26.00       0   0.0 [
     27.00       0   0.0 [
     28.00       0   0.0 [
     29.00       1   0.8 [*
     30.00       2   1.6 [*
```

```
PRC: REP      FILE NO.?6
                                          THRESHOLDS:  LOWER= 140  UPPER= 255

SUMMARY OF RESULTS                        MAGNIFICATION=                500
                                          GUARD REGION=               4.000 microns
LABEL: 85-197-P587-200-1100R  500X        MINIMUM PARTICLE SIZE=      0.500 microns
NUMBER OF FRAMES              1           MAXIMUM PARTICLE SIZE=      7.500 microns
NUMBER OF PARTICLES         607           LOW SHAPE FACTOR=           1.000
MAGNIFICATION               500           HIGH SHAPE FACTOR=          7.000
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um          FRAME NO.    1
ON PARTICLE SPACING=       0.04 um          TOTAL NO OF PARTICLES FOR FRAME=  607
FIELD AREA=            3.23E+04 um^2
TYPE          NAME                AVE.DIA.             MAX        MAX/MIN     AREA       PERIMETER
                                  MICRONS              MICRONS                uM^2       MICRONS
  0  ALL TYPES             2.09E+00 +-  2.16E+00   3.60E+00   3.27E+00  7.624E+00  9.712E+00
  2  KAOLINITE             2.40E+00 +-  1.82E+00   4.19E+00   2.98E+00  7.580E+00  1.076E+01
  3  ILLITE                1.85E+00 +-  1.42E+00   2.95E+00   2.93E+00  4.856E+00  7.812E+00
  4  QUARTZ                2.27E+00 +-  1.57E+00   3.49E+00   2.45E+00  7.518E+00  9.614E+00
  5  SIDERITE              3.38E+00 +-  0.00E+00   4.87E+00   1.84E+00  8.969E+00  1.208E+01
 15  APATITE               1.05E+00 +-  0.00E+00   1.53E+00   1.75E+00  9.231E-01  4.086E+00
 16  MONAZITE              1.80E+00 +-  0.00E+00   2.02E+00   1.31E+00  2.587E+00  6.020E+00
 22  ILLITE + Ti           1.95E+00 +-  1.55E-01   3.47E+00   2.96E+00  3.440E+00  9.206E+00
 23  ZIRCON                2.15E+00 +-  0.00E+00   5.27E+00   6.31E+00  3.473E+00  1.423E+01
 24  POLISH                2.06E+00 +-  1.41E+00   3.70E+00   3.59E+00  5.350E+00  9.871E+00
 62  NON-INT               2.14E+00 +-  2.61E+00   3.75E+00   3.63E+00  9.437E+00  1.029E+01
 63  UNKNOWN               1.71E+00 +-  1.73E+00   2.87E+00   2.87E+00  4.955E+00  7.769E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES              607    100.00      14.29
  2  KAOLINITE              102     16.80       2.38
  3  ILLITE                  14      2.30       0.20
  4  QUARTZ                  34      5.60       0.78
  5  SIDERITE                 1      0.16       0.02
 15  APATITE                  1      0.16       0.00
 16  MONAZITE                 1      0.16       0.00
 22  ILLITE + Ti              2      0.32       0.02
 23  ZIRCON                   1      0.16       0.01
 24  POLISH                  45      7.41       0.74
 62  NON-INT                280     46.12       8.16
 63  UNKNOWN                126     20.75       1.92
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75       91  14.9 [********
     1.00       73  12.0 [*******
     1.25       75  12.3 [*******
     1.50       60   9.8 [*****
     1.75       43   7.0 [****
     2.00       35   5.7 [***
     2.25       40   6.5 [****
     2.50       31   5.1 [***
     2.75       29   4.7 [***
     3.00       23   3.7 [**
     3.25       16   2.6 [**
     3.50       14   2.3 [**
     3.75        8   1.3 [*
     4.00        9   1.4 [*
     4.25        5   0.8 [*
     4.50       13   2.1 [**
     4.75        4   0.6 [*
     5.00        5   0.8 [*
     5.25        7   1.1 [*
     5.50        6   0.9 [*
     5.75        1   0.1 [*
     6.00        4   0.6 [*
     6.25        2   0.3 [*
     6.50        0   0.0 [
     6.75        1   0.1 [*
     7.00        1   0.1 [*
     7.25        1   0.1 [*
     7.50       10   1.6 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       5   4.9 [***
     1.00       7   6.8 [****
     1.25      11  10.7 [******
     1.50      14  13.7 [*******
     1.75       7   6.8 [****
     2.00      10   9.8 [*****
     2.25       9   8.8 [*****
     2.50       4   3.9 [**
     2.75       7   6.8 [****
     3.00       4   3.9 [**
     3.25       3   2.9 [**
     3.50       5   4.9 [***
     3.75       0   0.0 [
     4.00       2   1.9 [*
     4.25       1   0.9 [*
     4.50       4   3.9 [**
     4.75       0   0.0 [
     5.00       2   1.9 [*
     5.25       1   0.9 [*
     5.50       1   0.9 [*
     5.75       1   0.9 [*
     6.00       1   0.9 [*
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       3   2.9 [**

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2  14.2 [********
     1.00       2  14.2 [********
     1.25       4  28.5 [***************
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       2  14.2 [********
     2.25       1   7.1 [****
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1   7.1 [****
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       1   7.1 [****
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       1   7.1 [****
     5.75       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       4  11.7 [******
     1.00       5  14.7 [********
     1.25       3   8.8 [*****
     1.50       1   2.9 [**
     1.75       4  11.7 [******
     2.00       1   2.9 [**
     2.25       0   0.0 [
     2.50       3   8.8 [*****
     2.75       2   5.8 [***
     3.00       3   8.8 [*****
     3.25       1   2.9 [**
     3.50       2   5.8 [***
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       1   2.9 [**
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       1   2.9 [**
     5.25       1   2.9 [**
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       1   2.9 [**
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       1   2.9 [**
     7.25       0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      1  50.0 [*************************
     2.25      1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      0   0.0 [
     1.75      0   0.0 [
     2.00      0   0.0 [
     2.25      1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       7  15.5 [********
     1.00       4   8.8 [*****
     1.25       7  15.5 [********
     1.50       1   2.2 [**
     1.75       6  13.3 [*******
     2.00       3   6.6 [****
     2.25       2   4.4 [***
     2.50       1   2.2 [**
     2.75       2   4.4 [***
     3.00       2   4.4 [***
     3.25       1   2.2 [**
     3.50       1   2.2 [**
     3.75       2   4.4 [***
     4.00       1   2.2 [**
     4.25       0   0.0 [
     4.50       2   4.4 [***
     4.75       1   2.2 [**
     5.00       0   0.0 [
     5.25       1   2.2 [**
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       1   2.2 [**
     7.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      40  14.2 [********
     1.00      36  12.8 [*******
     1.25      33  11.7 [******
     1.50      29  10.3 [******
     1.75      20   7.1 [****
     2.00      14   5.0 [***
     2.25      19   6.7 [****
     2.50      19   6.7 [****
     2.75      15   5.3 [***
     3.00      10   3.5 [**
     3.25       8   2.8 [**
     3.50       4   1.4 [*
     3.75       4   1.4 [*
     4.00       3   1.0 [*
     4.25       2   0.7 [*
     4.50       4   1.4 [*
     4.75       2   0.7 [*
     5.00       2   0.7 [*
     5.25       3   1.0 [*
     5.50       3   1.0 [*
     5.75       0   0.0 [
     6.00       2   0.7 [*
     6.25       2   0.7 [*
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       1   0.3 [*
     7.50       5   1.7 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75      33  26.1 [**************
      1.00      19  15.0 [********
      1.25      16  12.6 [*******
      1.50      15  11.9 [******
      1.75       6   4.7 [***
      2.00       3   2.3 [**
      2.25       7   5.5 [***
      2.50       4   3.1 [**
      2.75       3   2.3 [**
      3.00       3   2.3 [**
      3.25       3   2.3 [**
      3.50       1   0.7 [*
      3.75       2   1.5 [*
      4.00       3   2.3 [**
      4.25       1   0.7 [*
      4.50       2   1.5 [*
      4.75       1   0.7 [*
      5.00       0   0.0 [
      5.25       1   0.7 [*
      5.50       1   0.7 [*
      5.75       0   0.0 [
      6.00       0   0.0 [
      6.25       0   0.0 [
      6.50       0   0.0 [
      6.75       0   0.0 [
      7.00       0   0.0 [
      7.25       0   0.0 [
      7.50       2   1.5 [*
```

```
PRC: REP

                                                  MAGNIFICATION=                50
                                                  GUARD REGION=             15.000 microns
SUMMARY OF RESULTS                                MINIMUM PARTICLE SIZE=     5.000 microns
                                                  MAXIMUM PARTICLE SIZE=    30.000 microns
LABEL: 85-197-P587-200-850-0-50X                  LOW SHAPE FACTOR=          1.000
NUMBER OF FRAMES              1                   HIGH SHAPE FACTOR=         7.000
NUMBER OF PARTICLES        1154
MAGNIFICATION                50
FIELD WIDTH=            1799.56 um
OFF PARTICLE SPACING=      4.83 um                   THRESHOLDS:  LOWER=  57  UPPER= 255 _
ON PARTICLE SPACING=       0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE          NAME                  AVE.DIA.             MAX       MAX/MIN      AREA      PERIMETER
                                    MICRONS             MICRONS                 uM^2      MICRONS
  0  ALL TYPES              9.69E+00 +-  4.62E+00   1.68E+01   3.57E+00  9.979E+01  4.955E+01
  2  KAOLINITE              1.01E+01 +-  6.10E+00   1.74E+01   3.40E+00  1.196E+02  5.049E+01
  3  ILLITE                 8.87E+00 +-  3.00E+00   1.68E+01   4.00E+00  7.883E+01  4.753E+01
  4  QUARTZ                 9.89E+00 +-  5.20E+00   1.72E+01   3.29E+00  1.058E+02  4.758E+01
  5  SIDERITE               1.40E+01 +-  6.32E+00   1.80E+01   1.89E+00  1.901E+02  5.416E+01
  6  CALCITE                5.27E+00 +-  0.00E+00   7.47E+00   1.00E+00  2.722E+01  2.197E+01
 10  SMECTITE               7.91E+00 +-  0.00E+00   1.09E+01   2.50E+00  4.895E+01  4.262E+01
 14  RUTILE                 1.09E+01 +-  0.00E+00   1.66E+01   2.92E+00  1.070E+02  4.833E+01
 15  APATITE                9.74E+00 +-  5.14E+00   1.75E+01   2.79E+00  1.023E+02  4.790E+01
 16  MONAZITE               1.12E+01 +-  1.55E+00   2.40E+01   6.05E+00  1.096E+02  7.294E+01
 22  ILLITE + Ti            9.47E+00 +-  4.13E+00   1.55E+01   2.97E+00  8.857E+01  5.116E+01
 23  ZIRCON                 7.83E+00 +-  2.41E+00   1.45E+01   3.94E+00  6.466E+01  4.248E+01
 24  POLISH                 1.05E+01 +-  4.05E+00   1.75E+01   3.10E+00  1.098E+02  5.188E+01
 62  NON-INT                8.69E+00 +-  3.50E+00   1.55E+01   3.92E+00  7.007E+01  4.612E+01
 63  UNKNOWN                9.82E+00 +-  4.60E+00   1.71E+01   3.76E+00  1.032E+02  5.202E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                      1154     100.00        3.55        FILE NO.?36
  2  KAOLINITE                       194      16.81        0.71        DRIVE NO.?2
  3  ILLITE                           29       2.51        0.07        LABEL: P587-200-850-0-50X
  4  QUARTZ                           84       7.27        0.27        NO. OF VIDEO SAMPLES   32?
  5  SIDERITE                          8       0.69        0.04
  6  CALCITE                           1       0.08        0.00
 10  SMECTITE                          1       0.08        0.00
 14  RUTILE                            1       0.08        0.00
 15  APATITE                           6       0.51        0.01
 16  MONAZITE                          2       0.17        0.00
 22  ILLITE + Ti                       7       0.60        0.01
 23  ZIRCON                            6       0.51        0.01
 24  POLISH                          211      18.28        0.71
 62  NON-INT                         330      28.59        0.79
 63  UNKNOWN                         274      23.74        0.87
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00      162  14.0 [********
     7.00      158  13.6 [*******
     8.00      212  18.3 [**********
     9.00      124  10.7 [******
    10.00       84   7.2 [****
    11.00      133  11.5 [******
    12.00       39   3.3 [**
    13.00       53   4.5 [***
    14.00       34   2.9 [**
    15.00       43   3.7 [**
    16.00       18   1.5 [*
    17.00       15   1.2 [*
    18.00       16   1.3 [*
    19.00       22   1.9 [*
    20.00       11   0.9 [*
    21.00        4   0.3 [*
    22.00        5   0.4 [*
    23.00        1   0.0 [*
    24.00        4   0.3 [*
    25.00        1   0.0 [*
    26.00        5   0.4 [*
    27.00        1   0.0 [*
    28.00        1   0.0 [*
    29.00        0   0.0 [
    30.00        8   0.6 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       25  12.8 [*******
     7.00       29  14.9 [********
     8.00       41  21.1 [***********
     9.00       22  11.3 [******
    10.00        8   4.1 [***
    11.00       20  10.3 [******
    12.00        3   1.5 [*
    13.00        9   4.6 [***
    14.00        4   2.0 [**
    15.00        8   4.1 [***
    16.00        6   3.0 [**
    17.00        2   1.0 [*
    18.00        1   0.5 [*
    19.00        4   2.0 [**
    20.00        3   1.5 [*
    21.00        2   1.0 [*
    22.00        1   0.5 [*
    23.00        0   0.0 [
    24.00        0   0.0 [
    25.00        0   0.0 [
    26.00        1   0.5 [*
    27.00        1   0.5 [*
    28.00        1   0.5 [*
    29.00        0   0.0 [
    30.00        3   1.5 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       6  20.6 [***********
     7.00       6  20.6 [***********
     8.00       1   3.4 [**
     9.00       2   6.8 [****
    10.00       2   6.8 [****
    11.00       5  17.2 [*********
    12.00       3  10.3 [******
    13.00       1   3.4 [**
    14.00       1   3.4 [**
    15.00       2   6.8 [****
    16.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      19  22.6 [************
     7.00       3   3.5 [**
     8.00      14  16.6 [*********
     9.00      10  11.9 [******
    10.00       5   5.9 [***
    11.00      11  13.0 [*******
    12.00       5   5.9 [***
    13.00       1   1.1 [*
    14.00       2   2.3 [**
    15.00       5   5.9 [***
    16.00       3   3.5 [**
    17.00       1   1.1 [*
    18.00       0   0.0 [
    19.00       2   2.3 [**
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       2   2.3 [**
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   1.1 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       2   25.0 [*************
     8.00       0    0.0 [
     9.00       1   12.5 [*******
    10.00       0    0.0 [
    11.00       0    0.0 [
    12.00       0    0.0 [
    13.00       1   12.5 [*******
    14.00       0    0.0 [
    15.00       0    0.0 [
    16.00       0    0.0 [
    17.00       0    0.0 [
    18.00       1   12.5 [*******
    19.00       1   12.5 [*******
    20.00       1   12.5 [*******
    21.00       0    0.0 [
    22.00       1   12.5 [*******
    23.00       0    0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       1  100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  10   NAME: SMECTITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       0    0.0 [
     8.00       1  100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       0    0.0 [
     8.00       0    0.0 [
     9.00       0    0.0 [
    10.00       0    0.0 [
    11.00       1  100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       2  33.3 [****************
     7.00       1  16.6 [********
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       2  33.3 [****************
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1  16.6 [********
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       1  50.0 [*************************
    12.00       0   0.0 [
    13.00       1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  14.2 [*******
     7.00       2  28.5 [**************
     8.00       0   0.0 [
     9.00       1  14.2 [*******
    10.00       0   0.0 [
    11.00       1  14.2 [*******
    12.00       0   0.0 [
    13.00       1  14.2 [*******
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       1  14.2 [*******
    18.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       2  33.3 [*****************
     7.00       1  16.6 [*********
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       2  33.3 [*****************
    11.00       1  16.6 [*********
    12.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      15   7.1 [****
     7.00      19   9.0 [*****
     8.00      33  15.6 [********
     9.00      23  10.9 [******
    10.00      15   7.1 [****
    11.00      33  15.6 [********
    12.00       9   4.2 [***
    13.00      18   8.5 [*****
    14.00      11   5.2 [***
    15.00       9   4.2 [***
    16.00       6   2.8 [**
    17.00       3   1.4 [*
    18.00       5   2.3 [**
    19.00       2   0.9 [*
    20.00       3   1.4 [*
    21.00       0   0.0 [
    22.00       1   0.4 [*
    23.00       1   0.4 [*
    24.00       4   1.8 [*
    25.00       0   0.0 [
    26.00       1   0.4 [*
    27.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      52  15.7 [********
     7.00      58  17.5 [*********
     8.00      75  22.7 [************
     9.00      33  10.0 [******
    10.00      30   9.0 [*****
    11.00      33  10.0 [******
    12.00       8   2.4 [**
    13.00       9   2.7 [**
    14.00       8   2.4 [**
    15.00       8   2.4 [**
    16.00       2   0.6 [*
    17.00       1   0.3 [*
    18.00       3   0.9 [*
    19.00       6   1.8 [*
    20.00       2   0.6 [*
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       1   0.3 [*
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   0.3 [*
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      39  14.2 [********
     7.00      37  13.5 [*******
     8.00      47  17.1 [*********
     9.00      32  11.6 [******
    10.00      22   8.0 [*****
    11.00      25   9.1 [*****
    12.00      11   4.0 [***
    13.00      12   4.3 [***
    14.00       8   2.9 [**
    15.00      11   4.0 [***
    16.00       1   0.3 [*
    17.00       7   2.5 [**
    18.00       6   2.1 [**
    19.00       6   2.1 [**
    20.00       2   0.7 [*
    21.00       2   0.7 [*
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       1   0.3 [*
    26.00       2   0.7 [*
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       3   1.0 [*
```

```
                FILE NO.?40
                LABEL: P52\207-200-850-0-500X
PRC: REP        NO. OF VIDEO SAMPLES   32?
                                                  THRESHOLDS:  LOWER=  57  UPPER= 255

SUMMARY OF RESULTS                             MAGNIFICATION=             500
                                               GUARD REGION=              4.000 microns
LABEL: 85-197-P507-200-850-0-500X              MINIMUM PARTICLE SIZE=     0.500 microns
NUMBER OF FRAMES              1                MAXIMUM PARTICLE SIZE=     7.500 microns
NUMBER OF PARTICLES         658                LOW SHAPE FACTOR=          1.000
MAGNIFICATION               500                HIGH SHAPE FACTOR=         7.000
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um
ON PARTICLE SPACING=       0.04 um
FIELD AREA=           3.23E+04 um^2
TYPE          NAME
                               AVE.DIA.                MAX        MAX/MIN      AREA       PERIMETER
                               MICRONS                 MICRONS                 uM^2       MICRONS
  0  ALL TYPES          1.84E+00 +-  1.21E+00   3.11E+00   3.18E+00   4.142E+00  8.377E+00
  2  KAOLINITE          2.05E+00 +-  1.20E+00   3.36E+00   2.27E+00   4.772E+00  8.665E+00
  3  ILLITE             1.39E+00 +-  1.09E+00   2.21E+00   2.51E+00   2.444E+00  5.954E+00
  4  QUARTZ             2.12E+00 +-  1.01E+00   3.31E+00   2.07E+00   4.504E+00  8.816E+00
  5  SIDERITE           1.49E+00 +-  0.00E+00   2.46E+00   2.54E+00   1.938E+00  6.284E+00
 14  RUTILE             8.34E-01 +-  0.00E+00   1.36E+00   2.30E+00   6.490E-01  3.339E+00
 15  APATITE            2.20E+00 +-  0.00E+00   3.73E+00   2.42E+00   4.454E+00  8.833E+00
 22  ILLITE + Ti        1.40E+00 +-  0.00E+00   4.57E+00   6.93E+00   2.193E+00  1.023E+01
 24  POLISH             1.65E+00 +-  1.44E+00   2.79E+00   3.59E+00   3.970E+00  7.920E+00
 62  NON-INT            1.87E+00 +-  1.24E+00   3.21E+00   3.39E+00   4.340E+00  8.642E+00
 63  UNKNOWN            1.65E+00 +-  8.41E-01   2.61E+00   2.49E+00   2.926E+00  7.141E+00
PARTICLE COUNT SUMMARY
TYPE          NAME
                               NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                  658     100.00       8.41
  2  KAOLINITE                   39       5.92       0.57
  3  ILLITE                       6       0.91       0.04
  4  QUARTZ                      16       2.43       0.22
  5  SIDERITE                     1       0.15       0.00
 14  RUTILE                       1       0.15       0.00
 15  APATITE                      1       0.15       0.01
 22  ILLITE + Ti                  1       0.15       0.00
 24  POLISH                      42       6.38       0.51
 62  NON-INT                    467      70.97       6.27
 63  UNKNOWN                     84      12.76       0.75
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      91  13.8 [*******
     1.00      78  11.8 [******
     1.25     102  15.5 [********
     1.50      70  10.6 [******
     1.75      46   6.9 [****
     2.00      51   7.7 [****
     2.25      44   6.6 [****
     2.50      32   4.8 [***
     2.75      20   3.0 [**
     3.00      28   4.2 [***
     3.25      15   2.2 [**
     3.50      16   2.4 [**
     3.75      14   2.1 [**
     4.00       7   1.0 [*
     4.25       5   0.7 [*
     4.50       7   1.0 [*
     4.75       9   1.3 [*
     5.00       2   0.3 [*
     5.25       5   0.7 [*
     5.50       3   0.4 [*
     5.75       4   0.6 [*
     6.00       3   0.4 [*
     6.25       2   0.3 [*
     6.50       2   0.3 [*
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       1   0.1 [*
     7.50       1   0.1 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2   5.1 [***
     1.00       3   7.6 [****
     1.25       7  17.9 [*********
     1.50       6  15.3 [********
     1.75       4  10.2 [******
     2.00       3   7.6 [****
     2.25       2   5.1 [***
     2.50       2   5.1 [***
     2.75       1   2.5 [**
     3.00       2   5.1 [***
     3.25       0   0.0 [
     3.50       1   2.5 [**
     3.75       1   2.5 [**
     4.00       1   2.5 [**
     4.25       1   2.5 [**
     4.50       1   2.5 [**
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       1   2.5 [**
     6.00       1   2.5 [**
     6.25       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25        0   0.0 [
    0.50        0   0.0 [
    0.75        1  16.6 [*********
    1.00        2  33.3 [*****************
    1.25        2  33.3 [*****************
    1.50        0   0.0 [
    1.75        0   0.0 [
    2.00        0   0.0 [
    2.25        0   0.0 [
    2.50        0   0.0 [
    2.75        0   0.0 [
    3.00        0   0.0 [
    3.25        0   0.0 [
    3.50        0   0.0 [
    3.75        1  16.6 [*********
    4.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25        0   0.0 [
    0.50        0   0.0 [
    0.75        1   6.2 [****
    1.00        1   6.2 [****
    1.25        4  25.0 [*************
    1.50        0   0.0 [
    1.75        0   0.0 [
    2.00        2  12.5 [*******
    2.25        1   6.2 [****
    2.50        1   6.2 [****
    2.75        0   0.0 [
    3.00        3  18.7 [**********
    3.25        0   0.0 [
    3.50        0   0.0 [
    3.75        3  18.7 [**********
    4.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25        0   0.0 [
    0.50        0   0.0 [
    0.75        0   0.0 [
    1.00        0   0.0 [
    1.25        0   0.0 [
    1.50        1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
    0.25        0   0.0 [
    0.50        0   0.0 [
    0.75        0   0.0 [
    1.00        1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0    0.0 [
     0.50        0    0.0 [
     0.75        0    0.0 [
     1.00        0    0.0 [
     1.25        0    0.0 [
     1.50        0    0.0 [
     1.75        0    0.0 [
     2.00        0    0.0 [
     2.25        0    0.0 [
     2.50        1  100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0    0.0 [
     0.50        0    0.0 [
     0.75        0    0.0 [
     1.00        0    0.0 [
     1.25        0    0.0 [
     1.50        1  100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0    0.0 [
     0.50        0    0.0 [
     0.75       13   30.9 [****************
     1.00        6   14.2 [********
     1.25        4    9.5 [*****
     1.50        5   11.9 [******
     1.75        2    4.7 [***
     2.00        3    7.1 [****
     2.25        1    2.3 [**
     2.50        2    4.7 [***
     2.75        0    0.0 [
     3.00        0    0.0 [
     3.25        0    0.0 [
     3.50        1    2.3 [**
     3.75        0    0.0 [
     4.00        0    0.0 [
     4.25        0    0.0 [
     4.50        1    2.3 [**
     4.75        1    2.3 [**
     5.00        0    0.0 [
     5.25        2    4.7 [***
     5.50        0    0.0 [
     5.75        0    0.0 [
     6.00        0    0.0 [
     6.25        0    0.0 [
     6.50        1    2.3 [**
     6.75        0    0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75       62  13.2 [*******
     1.00       57  12.2 [*******
     1.25       70  14.9 [********
     1.50       48  10.2 [******
     1.75       36   7.7 [****
     2.00       36   7.7 [****
     2.25       30   6.4 [****
     2.50       20   4.2 [***
     2.75       16   3.4 [**
     3.00       18   3.8 [**
     3.25       13   2.7 [**
     3.50       13   2.7 [**
     3.75        9   1.9 [*
     4.00        6   1.2 [*
     4.25        3   0.6 [*
     4.50        5   1.0 [*
     4.75        7   1.4 [*
     5.00        2   0.4 [*
     5.25        3   0.6 [*
     5.50        3   0.6 [*
     5.75        3   0.6 [*
     6.00        2   0.4 [*
     6.25        2   0.4 [*
     6.50        1   0.2 [*
     6.75        0   0.0 [
     7.00        0   0.0 [
     7.25        1   0.2 [*
     7.50        1   0.2 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75       12  14.2 [********
     1.00        8   9.5 [*****
     1.25       15  17.8 [*********
     1.50        9  10.7 [******
     1.75        4   4.7 [***
     2.00        7   8.3 [*****
     2.25       10  11.9 [******
     2.50        6   7.1 [****
     2.75        3   3.5 [**
     3.00        5   5.9 [***
     3.25        2   2.3 [**
     3.50        1   1.1 [*
     3.75        0   0.0 [
     4.00        0   0.0 [
     4.25        1   1.1 [*
     4.50        0   0.0 [
     4.75        1   1.1 [*
     5.00        0   0.0 [
                                                  MAGNIFICATION=                     50
SUMMARY OF RESULTS                                GUARD REGION=                  15.000 microns
                                                  MINIMUM PARTICLE SIZE=          5.000 microns
LABEL: 85-197-P587-200-1100-0    50 X             MAXIMUM PARTICLE SIZE=         30.000 microns
NUMBER OF FRAMES                 1                LOW SHAPE FACTOR=               1.000
NUMBER OF PARTICLES           1120                HIGH SHAPE FACTOR=              7.000
MAGNIFICATION                   50
FIELD WIDTH=               1799.56 um
OFF PARTICLE SPACING=         4.83 um             THRESHOLDS:  LOWER=  76  UPPER= 255
ON PARTICLE SPACING=          0.43 um
FIELD AREA=               3.23E+06 um^2
TYPE          NAME
                                    AVE.DIA.               MAX       MAX/MIN     AREA      PERIMETER
                                    MICRONS              MICRONS                 uM^2      MICRONS
   0  ALL TYPES              1.28E+01 +-  6.39E+00    2.29E+01   4.00E+00  1.788E+02  6.893E+01
   2  KAOLINITE              1.16E+01 +-  6.89E+00    2.09E+01   3.67E+00  1.607E+02  6.095E+01
   3  ILLITE                 1.13E+01 +-  5.60E+00    1.98E+01   4.00E+00  1.365E+02  6.125E+01
   4  QUARTZ                 1.12E+01 +-  5.66E+00    1.91E+01   3.29E+00  1.384E+02  5.464E+01
   7  ANKERITE               1.09E+01 +-  1.24E+00    1.73E+01   2.45E+00  1.076E+02  5.229E+01
   9  CHLORITE               8.34E+00 +-  0.00E+00    1.75E+01   3.63E+00  6.324E+01  4.482E+01
  13  HALITE                 7.03E+00 +-  0.00E+00    1.05E+01   3.00E+00  4.383E+01  2.760E+01
  14  RUTILE                 7.91E+00 +-  0.00E+00    1.14E+01   1.73E+00  5.243E+01  3.427E+01
  15  APATITE                1.64E+01 +-  7.26E+00    3.17E+01   4.06E+00  2.442E+02  9.667E+01
  16  MONAZITE               5.71E+00 +-  0.00E+00    9.66E+00   3.66E+00  2.722E+01  3.823E+01
  22  ILLITE + Ti            9.44E+00 +-  4.03E+00    1.86E+01   1.32E+01  9.313E+01  6.108E+01
  23  ZIRCON                 1.49E+01 +-  1.24E+01    2.26E+01   3.17E+00  2.289E+02  9.492E+01
  24  POLISH                 1.37E+01 +-  6.27E+00    2.35E+01   3.25E+00  1.969E+02  7.018E+01
  62  NON-INT                1.25E+01 +-  6.03E+00    2.36E+01   5.37E+00  1.689E+02  7.374E+01
  63  UNKNOWN                1.25E+01 +-  6.60E+00    2.36E+01   4.63E+00  1.777E+02  7.130E+01

PARTICLE COUNT SUMMARY
TYPE           NAME
                                 NUMBER     #(%)     T.AREA(%)
   0  ALL TYPES                   1120     100.00       6.18
   2  KAOLINITE                    134      11.96       0.66
   3  ILLITE                        18       1.60       0.07
   4  QUARTZ                        58       5.17       0.24
   7  ANKERITE                       2       0.17       0.00
   9  CHLORITE                       1       0.08       0.00
  13  HALITE                         1       0.08       0.00
  14  RUTILE                         1       0.08       0.00
  15  APATITE                        4       0.35       0.03
  16  MONAZITE                       1       0.08       0.00
  22  ILLITE + Ti                    2       0.17       0.00
  23  ZIRCON                         2       0.17       0.01
  24  POLISH                       446      39.82       2.71
  62  NON-INT                      174      15.53       0.90
  63  UNKNOWN                      276      24.64       1.51

PRC: HIS




FILE NO.?9
DRIVE NO.?2
LABEL: P587-200-11000 500X\0
NO. OF VIDEO SAMPLES   32?
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       86   7.6 [****
     7.00       84   7.5 [****
     8.00      130  11.6 [******
     9.00       80   7.1 [****
    10.00       74   6.6 [****
    11.00      104   9.2 [*****
    12.00       54   4.8 [***
    13.00       69   6.1 [****
    14.00       55   4.9 [***
    15.00       75   6.6 [****
    16.00       31   2.7 [**
    17.00       27   2.4 [**
    18.00       31   2.7 [**
    19.00       34   3.0 [**
    20.00       24   2.1 [**
    21.00       20   1.7 [*
    22.00       33   2.9 [**
    23.00       21   1.8 [*
    24.00       13   1.1 [*
    25.00       10   0.8 [*
    26.00       14   1.2 [*
    27.00        7   0.6 [*
    28.00        7   0.6 [*
    29.00        6   0.5 [*
    30.00       31   2.7 [**

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       20  14.9 [********
     7.00       16  11.9 [******
     8.00       16  11.9 [******
     9.00       11   8.2 [*****
    10.00        8   5.9 [***
    11.00       10   7.4 [****
    12.00        8   5.9 [***
    13.00        8   5.9 [***
    14.00        4   2.9 [**
    15.00        7   5.2 [***
    16.00        2   1.4 [*
    17.00        2   1.4 [*
    18.00        1   0.7 [*
    19.00        3   2.2 [**
    20.00        1   0.7 [*
    21.00        3   2.2 [**
    22.00        2   1.4 [*
    23.00        2   1.4 [*
    24.00        0   0.0 [
    25.00        1   0.7 [*
    26.00        1   0.7 [*
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        2   1.4 [*
    30.00        6   4.4 [***
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       2  11.1 [******
     7.00       2  11.1 [******
     8.00       2  11.1 [******
     9.00       1   5.5 [***
    10.00       2  11.1 [******
    11.00       3  16.6 [**********
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       2  11.1 [******
    16.00       1   5.5 [***
    17.00       0   0.0 [
    18.00       1   5.5 [***
    19.00       0   0.0 [
    20.00       1   5.5 [***
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       1   5.5 [***
    28.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       6  10.3 [******
     7.00       7  12.0 [*******
     8.00       9  15.5 [*********
     9.00       3   5.1 [***
    10.00       7  12.0 [*******
    11.00       4   6.8 [****
    12.00       0   0.0 [
    13.00       6  10.3 [******
    14.00       3   5.1 [***
    15.00       1   1.7 [*
    16.00       3   5.1 [***
    17.00       1   1.7 [*
    18.00       1   1.7 [*
    19.00       0   0.0 [
    20.00       1   1.7 [*
    21.00       2   3.4 [**
    22.00       1   1.7 [*
    23.00       1   1.7 [*
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       1   1.7 [*
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   1.7 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   7   NAME: ANKERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       0    0.0 [
     8.00       0    0.0 [
     9.00       0    0.0 [
    10.00       0    0.0 [
    11.00       1   50.0 [*************************
    12.00       1   50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   9   NAME: CHLORITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       0    0.0 [
     8.00       0    0.0 [
     9.00       1  100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  13   NAME: HALITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       0    0.0 [
     8.00       1  100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0    0.0 [
     2.00       0    0.0 [
     3.00       0    0.0 [
     4.00       0    0.0 [
     5.00       0    0.0 [
     6.00       0    0.0 [
     7.00       0    0.0 [
     8.00       1  100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       1  25.0 [*************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       1  25.0 [*************
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       1  25.0 [*************
    23.00       0   0.0 [
    24.00       1  25.0 [*************
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       1  50.0 [**************************
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       1  50.0 [**************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        0   0.0 [
     7.00        1  50.0 [**************************
     8.00        0   0.0 [
     9.00        0   0.0 [
    10.00        0   0.0 [
    11.00        0   0.0 [
    12.00        0   0.0 [
    13.00        0   0.0 [
    14.00        0   0.0 [
    15.00        0   0.0 [
    16.00        0   0.0 [
    17.00        0   0.0 [
    18.00        0   0.0 [
    19.00        0   0.0 [
    20.00        0   0.0 [
    21.00        0   0.0 [
    22.00        0   0.0 [
    23.00        0   0.0 [
    24.00        1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       19   4.2 [***
     7.00       19   4.2 [***
     8.00       41   9.1 [*****
     9.00       33   7.3 [****
    10.00       33   7.3 [****
    11.00       42   9.4 [*****
    12.00       27   6.0 [****
    13.00       28   6.2 [****
    14.00       19   4.2 [***
    15.00       40   8.9 [*****
    16.00       14   3.1 [**
    17.00       14   3.1 [**
    18.00       15   3.3 [**
    19.00       19   4.2 [***
    20.00       10   2.2 [**
    21.00        9   2.0 [**
    22.00       18   4.0 [***
    23.00        6   1.3 [*
    24.00        6   1.3 [*
    25.00        4   0.8 [*
    26.00        7   1.5 [*
    27.00        3   0.6 [*
    28.00        5   1.1 [*
    29.00        3   0.6 [*
    30.00       12   2.6 [**
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      12   6.8 [****
     7.00      18  10.3 [******
     8.00      19  10.9 [******
     9.00      11   6.3 [****
    10.00      12   6.8 [****
    11.00      17   9.7 [*****
    12.00       5   2.8 [**
    13.00      10   5.7 [***
    14.00      17   9.7 [*****
    15.00       8   4.5 [***
    16.00       4   2.2 [**
    17.00       4   2.2 [**
    18.00       3   1.7 [*
    19.00       6   3.4 [**
    20.00       5   2.8 [**
    21.00       4   2.2 [**
    22.00       3   1.7 [*
    23.00       4   2.2 [**
    24.00       3   1.7 [*
    25.00       3   1.7 [*
    26.00       0   0.0 [
    27.00       1   0.5 [*
    28.00       1   0.5 [*
    29.00       0   0.0 [
    30.00       4   2.2 [**

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      26   9.4 [*****
     7.00      20   7.2 [****
     8.00      40  14.4 [********
     9.00      20   7.2 [****
    10.00      12   4.3 [***
    11.00      27   9.7 [*****
    12.00      13   4.7 [***
    13.00      16   5.7 [***
    14.00      11   3.9 [**
    15.00      17   6.1 [****
    16.00       7   2.5 [**
    17.00       6   2.1 [**
    18.00      10   3.6 [**
    19.00       6   2.1 [**
    20.00       6   2.1 [**
    21.00       2   0.7 [*
    22.00       8   2.8 [**
    23.00       8   2.8 [**
    24.00       2   0.7 [*
    25.00       2   0.7 [*
    26.00       6   2.1 [**
    27.00       1   0.3 [*
    28.00       1   0.3 [*
    29.00       1   0.3 [*
    30.00       8   2.8 [**
```

```
                                                  PRP:
                                                  NUMBER OF ANALYSES TO BE MERGED?1
LABEL: 85-197-P587-200-1100-0   50 X              FILE NO.?9
LISTING OPTIONS SELECTED:                                                PAGE:   1
  TYPE: UNKNOWN

PART NO:     4  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      556
ELEMENT CONCENTRATIONS:
Al: 44    Si: 32    S :  1    K :  0    Ca:  0    Cl:  6
Fe:  1    Ti:  0    Mg:  0    Na:  0    P :  2    Cu:  2
Ce:  0    Zn:  0    Ba:  7    Pb:  1
AVE DIA=        7.91 uM  MAX DIA=       11.42 uM  MIN DIA=        5.71 uM
AREA=      56.68 uM^2  PERIMETER=       33.83 uM  SHAPE FACTOR=   1.607

PART NO:    10  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      507
ELEMENT CONCENTRATIONS:
Al: 36    Si: 21    S :  4    K :  3    Ca:  0    Cl:  0
Fe:  0    Ti:  8    Mg:  0    Na:  0    P :  7    Cu:  7
Ce:  0    Zn:  4    Ba:  0    Pb:  3
AVE DIA=       12.30 uM  MAX DIA=       31.64 uM  MIN DIA=        6.15 uM
AREA=     147.44 uM^2  PERIMETER=       71.19 uM  SHAPE FACTOR=   2.734

PART NO:    26  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      867
ELEMENT CONCENTRATIONS:
Al: 37    Si: 43    S :  3    K :  0    Ca:  3    Cl:  1
Fe:  2    Ti:  6    Mg:  0    Na:  1    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       12.74 uM  MAX DIA=       17.57 uM  MIN DIA=        7.91 uM
AREA=     130.45 uM^2  PERIMETER=       64.59 uM  SHAPE FACTOR=   2.545

PART NO:    31  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      564
ELEMENT CONCENTRATIONS:
Al: 20    Si: 55    S :  1    K :  0    Ca:  9    Cl:  0
Fe:  1    Ti:  0    Mg:  4    Na:  0    P :  0    Cu:  4
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       15.82 uM  MAX DIA=       30.32 uM  MIN DIA=        7.03 uM
AREA=     205.38 uM^2  PERIMETER=       87.45 uM  SHAPE FACTOR=   2.962

PART NO:    33  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      396
ELEMENT CONCENTRATIONS:
Al: 45    Si: 31    S :  3    K :  1    Ca:  0    Cl:  0
Fe:  5    Ti:  5    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  3    Zn:  2    Ba:  1    Pb:  0
AVE DIA=       13.62 uM  MAX DIA=       34.27 uM  MIN DIA=        3.51 uM
AREA=     356.01 uM^2  PERIMETER=       91.84 uM  SHAPE FACTOR=   1.885
```

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LABEL: 85-197-P587-200-1100-0   500X                             PAGE:   2

PART NO:     34  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:        940
ELEMENT CONCENTRATIONS:
Al: 43     Si: 14     S :  1     K :  0     Ca:  0     Cl:  0
Fe: 29     Ti:  0     Mg:  3     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  0     Ba:  4     Pb:  2
AVE DIA=       14.50 uM  MAX DIA=       18.45 uM  MIN DIA=       10.98 uM
AREA=      167.14 uM^2  PERIMETER=       61.52 uM  SHAPE FACTOR=   1.801

PART NO:     39  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:        671
ELEMENT CONCENTRATIONS:
Al: 43     Si: 27     S :  6     K :  1     Ca:  0     Cl:  9
Fe:  0     Ti:  1     Mg:  0     Na:  0     P :  7     Cu:  0
Ce:  0     Zn:  1     Ba:  1     Pb:  0
AVE DIA=       19.77 uM  MAX DIA=       30.76 uM  MIN DIA=       13.62 uM
AREA=      328.68 uM^2  PERIMETER=       87.01 uM  SHAPE FACTOR=   1.832

PART NO:     44  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:        574
ELEMENT CONCENTRATIONS:
Al: 50     Si:  1     S :  1     K :  0     Ca:  0     Cl:  6
Fe: 32     Ti:  6     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  0     Ba:  0     Pb:  0
AVE DIA=        6.15 uM  MAX DIA=       10.54 uM  MIN DIA=        3.51 uM
AREA=       33.79 uM^2  PERIMETER=       34.71 uM  SHAPE FACTOR=   2.837

PART NO:     48  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:        822
ELEMENT CONCENTRATIONS:
Al: 59     Si: 23     S :  2     K :  0     Ca:  0     Cl:  3
Fe:  2     Ti:  0     Mg:  0     Na:  0     P :  4     Cu:  0
Ce:  0     Zn:  0     Ba:  0     Pb:  1
AVE DIA=       11.86 uM  MAX DIA=       31.20 uM  MIN DIA=        4.83 uM
AREA=      117.89 uM^2  PERIMETER=       74.26 uM  SHAPE FACTOR=   3.722

PART NO:     54  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:        843
ELEMENT CONCENTRATIONS:
Al: 25     Si: 54     S :  6     K :  2     Ca:  2     Cl:  0
Fe:  0     Ti:  0     Mg:  2     Na:  0     P :  0     Cu:  2
Ce:  0     Zn:  0     Ba:  2     Pb:  0
AVE DIA=       10.54 uM  MAX DIA=       18.89 uM  MIN DIA=        5.71 uM
AREA=       94.04 uM^2  PERIMETER=       56.68 uM  SHAPE FACTOR=   2.718

PART NO:     64  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:        320
ELEMENT CONCENTRATIONS:
Al: 47     Si: 13     S :  0     K :  5     Ca:  0     Cl:  0
Fe: 14     Ti:  0     Mg:  0     Na:  3     P :  6     Cu:  9
Ce:  0     Zn:  0     Ba:  0     Pb:  0
AVE DIA=       16.69 uM  MAX DIA=       27.68 uM  MIN DIA=        5.27 uM
AREA=      245.55 uM^2  PERIMETER=       96.67 uM  SHAPE FACTOR=   3.028
```

```
PART NO:    66  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      844
ELEMENT CONCENTRATIONS:
Al: 20    Si: 61    S :  5    K :  1    Ca:  2    Cl:  0
Fe:  2    Ti:  2    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  1    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        7.91 uM  MAX DIA=       13.62 uM  MIN DIA=        4.83 uM
AREA=      55.23 uM^2  PERIMETER=      34.27 uM  SHAPE FACTOR=   1.692

PART NO:    70  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      500
ELEMENT CONCENTRATIONS:
Al: 31    Si: 34    S :  0    K :  2    Ca:  5    Cl:  0
Fe:  7    Ti:  8    Mg:  1    Na:  1    P :  0    Cu:  4
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        7.47 uM  MAX DIA=       16.69 uM  MIN DIA=        3.95 uM
AREA=      66.52 uM^2  PERIMETER=      43.06 uM  SHAPE FACTOR=   2.218

PART NO:    74  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      834
ELEMENT CONCENTRATIONS:
Al: 30    Si: 49    S :  5    K :  1    Ca:  0    Cl:  8
Fe:  1    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=        9.22 uM  MAX DIA=       21.53 uM  MIN DIA=        1.75 uM
AREA=     108.62 uM^2  PERIMETER=      59.76 uM  SHAPE FACTOR=   2.616

PART NO:    82  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      408
ELEMENT CONCENTRATIONS:
Al: 25    Si: 31    S :  5    K :  4    Ca:  2    Cl: 11
Fe:  0    Ti:  2    Mg:  3    Na:  0    P :  0    Cu:  4
Ce:  0    Zn:  0    Ba:  2    Pb:  5
AVE DIA=        5.27 uM  MAX DIA=       10.54 uM  MIN DIA=        2.19 uM
AREA=      29.25 uM^2  PERIMETER=      27.68 uM  SHAPE FACTOR=   2.084

PART NO:    88  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      835
ELEMENT CONCENTRATIONS:
Al: 56    Si: 19    S :  3    K :  2    Ca:  1    Cl:  4
Fe:  1    Ti:  5    Mg:  1    Na:  0    P :  2    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       13.18 uM  MAX DIA=       21.97 uM  MIN DIA=        5.71 uM
AREA=     154.68 uM^2  PERIMETER=      68.99 uM  SHAPE FACTOR=   2.448

PART NO:    89  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      957
ELEMENT CONCENTRATIONS:
Al: 11    Si: 73    S :  0    K :  0    Ca:  2    Cl:  1
Fe:  1    Ti:  0    Mg:  2    Na:  0    P :  2    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  1
AVE DIA=        9.66 uM  MAX DIA=       13.62 uM  MIN DIA=        7.03 uM
AREA=      78.30 uM^2  PERIMETER=      42.18 uM  SHAPE FACTOR=   1.808
```

```
PART NO:    91  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      556
ELEMENT CONCENTRATIONS:
Al: 16    Si: 52    S :  0    K :  2    Ca:  0    Cl:  1
Fe:  1    Ti: 19    Mg:  2    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  2    Ba:  1    Pb:  0
AVE DIA=        36.03 uM  MAX DIA=       67.67 uM  MIN DIA=       28.12 uM
AREA=    1046.60 uM^2  PERIMETER=     171.38 uM  SHAPE FACTOR=   2.233

PART NO:    98  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      410
ELEMENT CONCENTRATIONS:
Al: 35    Si: 19    S : 10    K :  0    Ca:  0    Cl:  0
Fe:  4    Ti:  7    Mg:  3    Na:  4    P :  4    Cu:  0
Ce:  1    Zn:  5    Ba:  4    Pb:  0
AVE DIA=         7.91 uM  MAX DIA=       16.69 uM  MIN DIA=        4.83 uM
AREA=      49.43 uM^2  PERIMETER=      50.53 uM  SHAPE FACTOR=   4.110

PART NO:   106  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1175
ELEMENT CONCENTRATIONS:
Al: 68    Si:  1    S :  0    K :  2    Ca:  3    Cl:  0
Fe:  5    Ti:  0    Mg:  0    Na:  1    P :  6    Cu:  4
Ce:  0    Zn:  1    Ba:  5    Pb:  0
AVE DIA=        13.62 uM  MAX DIA=       27.24 uM  MIN DIA=        5.27 uM
AREA=     182.11 uM^2  PERIMETER=      84.81 uM  SHAPE FACTOR=   3.142

PART NO:   109  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      406
ELEMENT CONCENTRATIONS:
Al: 50    Si: 19    S :  0    K :  0    Ca:  1    Cl:  0
Fe:  0    Ti:  6    Mg:  0    Na:  0    P :  6    Cu:  2
Ce:  4    Zn:  0    Ba:  3    Pb:  3
AVE DIA=        14.06 uM  MAX DIA=       36.91 uM  MIN DIA=        5.71 uM
AREA=     201.32 uM^2  PERIMETER=     100.63 uM  SHAPE FACTOR=   4.002

PART NO:   111  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1147
ELEMENT CONCENTRATIONS:
Al: 21    Si: 65    S :  3    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  0    Mg:  1    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  2    Pb:  1
AVE DIA=         7.47 uM  MAX DIA=       18.45 uM  MIN DIA=        3.51 uM
AREA=      45.57 uM^2  PERIMETER=      47.90 uM  SHAPE FACTOR=   4.005

PART NO:   114  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      440
ELEMENT CONCENTRATIONS:
Al: 31    Si: 22    S :  0    K :  1    Ca:  9    Cl:  3
Fe: 14    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  7    Zn:  2    Ba:  0    Pb:  5
AVE DIA=        12.30 uM  MAX DIA=       32.08 uM  MIN DIA=        2.63 uM
AREA=     131.99 uM^2  PERIMETER=      95.36 uM  SHAPE FACTOR=   5.481
```

```
PART NO:   117  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       397
ELEMENT CONCENTRATIONS:
Al: 56    Si: 23    S :  8    K :  0    Ca:  0    Cl:  0
Fe:  3    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  1    Zn:  0    Ba:  0    Pb:  2
AVE DIA=        8.34 uM  MAX DIA=      12.30 uM  MIN DIA=       3.95 uM
AREA=      63.05 uM^2  PERIMETER=      40.86 uM  SHAPE FACTOR=   2.107

PART NO:   122  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       453
ELEMENT CONCENTRATIONS:
Al: 20    Si: 39    S :  4    K :  0    Ca:  0    Cl:  3
Fe:  1    Ti:  8    Mg:  3    Na:  3    P :  0    Cu:  2
Ce:  0    Zn:  5    Ba:  1    Pb:  5
AVE DIA=        5.27 uM  MAX DIA=       7.91 uM  MIN DIA=       1.75 uM
AREA=      22.49 uM^2  PERIMETER=      40.86 uM  SHAPE FACTOR=   5.907

PART NO:   125  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       382
ELEMENT CONCENTRATIONS:
Al: 42    Si: 31    S :  0    K :  0    Ca:  0    Cl:  5
Fe:  6    Ti:  6    Mg:  0    Na:  0    P :  0    Cu:  6
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=        8.78 uM  MAX DIA=      14.50 uM  MIN DIA=       4.39 uM
AREA=      64.69 uM^2  PERIMETER=      44.82 uM  SHAPE FACTOR=   2.471

PART NO:   126  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       384
ELEMENT CONCENTRATIONS:
Al: 27    Si: 36    S :  6    K : 10    Ca:  0    Cl:  0
Fe:  1    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  7
Ce:  5    Zn:  0    Ba:  3    Pb:  0
AVE DIA=       16.25 uM  MAX DIA=      27.24 uM  MIN DIA=      12.30 uM
AREA=     215.52 uM^2  PERIMETER=      78.22 uM  SHAPE FACTOR=   2.258

PART NO:   127  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       648
ELEMENT CONCENTRATIONS:
Al: 34    Si: 39    S :  5    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  4    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  4    Zn:  1    Ba:  5    Pb:  3
AVE DIA=       10.10 uM  MAX DIA=      15.30 uM  MIN DIA=       6.59 uM
AREA=      87.09 uM^2  PERIMETER=      45.70 uM  SHAPE FACTOR=   1.908

PART NO:   128  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       441
ELEMENT CONCENTRATIONS:
Al:  3    Si: 72    S :  2    K :  0    Ca:  0    Cl:  0
Fe:  2    Ti:  8    Mg:  1    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  0    Pb:  5
AVE DIA=        7.03 uM  MAX DIA=       9.66 uM  MIN DIA=       3.95 uM
AREA=      41.81 uM^2  PERIMETER=      29.44 uM  SHAPE FACTOR=   1.649
```

```
PART NO:   137  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     387
ELEMENT CONCENTRATIONS:
Al: 54    Si: 22    S :  4    K :  8    Ca:  0    Cl:  0
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  5    Zn:  2    Ba:  0    Pb:  0
AVE DIA=       12.74 uM  MAX DIA=      43.06 uM  MIN DIA=       4.83 uM
AREA=     140.88 uM^2  PERIMETER=     103.71 uM  SHAPE FACTOR=   6.074

PART NO:   138  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1098
ELEMENT CONCENTRATIONS:
Al: 51    Si: 31    S :  4    K :  0    Ca:  2    Cl:  0
Fe:  3    Ti:  2    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       12.30 uM  MAX DIA=      18.45 uM  MIN DIA=       9.22 uM
AREA=     123.98 uM^2  PERIMETER=      57.56 uM  SHAPE FACTOR=   2.126

PART NO:   146  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     434
ELEMENT CONCENTRATIONS:
Al: 44    Si:  0    S :  3    K :  0    Ca: 11    Cl:  0
Fe:  9    Ti:  7    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  8    Zn:  3    Ba:  5    Pb:  2
AVE DIA=       16.25 uM  MAX DIA=      29.44 uM  MIN DIA=      10.10 uM
AREA=     233.09 uM^2  PERIMETER=      82.17 uM  SHAPE FACTOR=   2.305

PART NO:   152  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1143
ELEMENT CONCENTRATIONS:
Al:  5    Si: 79    S :  3    K :  0    Ca:  3    Cl:  0
Fe:  3    Ti:  0    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  1    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       13.18 uM  MAX DIA=      26.36 uM  MIN DIA=       8.34 uM
AREA=     127.84 uM^2  PERIMETER=      75.58 uM  SHAPE FACTOR=   3.555

PART NO:   154  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     398
ELEMENT CONCENTRATIONS:
Al: 49    Si: 22    S :  0    K :  0    Ca:  0    Cl:  4
Fe:  3    Ti:  6    Mg:  1    Na:  2    P :  0    Cu:  1
Ce:  2    Zn:  0    Ba:  6    Pb:  0
AVE DIA=       13.18 uM  MAX DIA=      33.39 uM  MIN DIA=       4.39 uM
AREA=     181.43 uM^2  PERIMETER=      85.69 uM  SHAPE FACTOR=   3.220

PART NO:   155  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     468
ELEMENT CONCENTRATIONS:
Al: 48    Si:  6    S :  0    K :  6    Ca:  6    Cl:  1
Fe:  6    Ti:  0    Mg:  0    Na:  1    P :  2    Cu:  5
Ce:  7    Zn:  0    Ba:  3    Pb:  2
AVE DIA=        7.91 uM  MAX DIA=      11.42 uM  MIN DIA=       2.19 uM
AREA=      57.83 uM^2  PERIMETER=      43.94 uM  SHAPE FACTOR=   2.656
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```
PART NO:   159  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     378
ELEMENT CONCENTRATIONS:
Al: 42    Si: 32    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  8    Ti:  6    Mg:  2    Na:  0    P :  6    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       8.78 uM  MAX DIA=       23.29 uM  MIN DIA=       4.83 uM
AREA=      53.10 uM^2  PERIMETER=      58.44 uM  SHAPE FACTOR=   5.118

PART NO:   161  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1446
ELEMENT CONCENTRATIONS:
Al: 43    Si: 42    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  4    Mg:  0    Na:  0    P :  1    Cu:  1
Ce:  1    Zn:  1    Ba:  0    Pb:  0
AVE DIA=      25.48 uM  MAX DIA=       43.06 uM  MIN DIA=      11.42 uM
AREA=     522.58 uM^2  PERIMETER=     136.66 uM  SHAPE FACTOR=   2.843

PART NO:   162  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     558
ELEMENT CONCENTRATIONS:
Al: 56    Si: 31    S :  0    K :  3    Ca:  0    Cl:  0
Fe:  0    Ti:  5    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=      12.74 uM  MAX DIA=       24.16 uM  MIN DIA=       5.71 uM
AREA=     108.43 uM^2  PERIMETER=      97.11 uM  SHAPE FACTOR=   6.920

PART NO:   163  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1068
ELEMENT CONCENTRATIONS:
Al: 11    Si: 70    S :  0    K :  2    Ca:  0    Cl:  1
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  2    Zn:  0    Ba:  3    Pb:  2
AVE DIA=      13.18 uM  MAX DIA=       39.99 uM  MIN DIA=       3.51 uM
AREA=     179.31 uM^2  PERIMETER=      92.28 uM  SHAPE FACTOR=   3.779

PART NO:   166  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1022
ELEMENT CONCENTRATIONS:
Al: 20    Si: 65    S :  0    K :  2    Ca:  0    Cl:  0
Fe:  0    Ti:  3    Mg:  2    Na:  0    P :  3    Cu:  0
Ce:  0    Zn:  2    Ba:  0    Pb:  2
AVE DIA=      33.39 uM  MAX DIA=       56.68 uM  MIN DIA=      22.41 uM
AREA=     944.64 uM^2  PERIMETER=     157.76 uM  SHAPE FACTOR=   2.096

PART NO:   168  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     521
ELEMENT CONCENTRATIONS:
Al: 20    Si: 72    S :  0    K :  0    Ca:  0    Cl:  2
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  1
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=      14.50 uM  MAX DIA=       24.16 uM  MIN DIA=       6.15 uM
AREA=     191.86 uM^2  PERIMETER=      78.22 uM  SHAPE FACTOR=   2.537
```

```
PART NO:   169  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1031
ELEMENT CONCENTRATIONS:
Al: 11     Si: 71     S :  4     K :  0     Ca:  0     Cl:  0
Fe:  2     Ti:  0     Mg:  2     Na:  1     P :  1     Cu:  3
Ce:  0     Zn:  0     Ba:  0     Pb:  0
AVE DIA=        21.09 uM  MAX DIA=        33.39 uM  MIN DIA=        9.66 uM
AREA=      373.78 uM^2  PERIMETER=       116.01 uM  SHAPE FACTOR=   2.865

PART NO:   173  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      615
ELEMENT CONCENTRATIONS:
Al: 19     Si: 55     S :  5     K :  2     Ca:  0     Cl:  0
Fe:  5     Ti:  3     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  2     Ba:  2     Pb:  3
AVE DIA=         7.03 uM  MAX DIA=        20.65 uM  MIN DIA=        2.63 uM
AREA=       42.48 uM^2  PERIMETER=        59.76 uM  SHAPE FACTOR=   6.689

PART NO:   182  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      995
ELEMENT CONCENTRATIONS:
Al: 30     Si: 52     S :  6     K :  0     Ca:  0     Cl:  3
Fe:  0     Ti:  0     Mg:  0     Na:  0     P :  3     Cu:  0
Ce:  0     Zn:  0     Ba:  0     Pb:  2
AVE DIA=         8.78 uM  MAX DIA=        15.38 uM  MIN DIA=        4.83 uM
AREA=       65.95 uM^2  PERIMETER=        43.06 uM  SHAPE FACTOR=   2.237

PART NO:   186  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      401
ELEMENT CONCENTRATIONS:
Al: 46     Si: 12     S :  1     K :  9     Ca:  0     Cl:  5
Fe:  0     Ti:  0     Mg:  7     Na:  4     P :  0     Cu:  6
Ce:  0     Zn:  1     Ba:  2     Pb:  0
AVE DIA=         7.91 uM  MAX DIA=        18.45 uM  MIN DIA=        4.83 uM
AREA=       68.84 uM^2  PERIMETER=        57.12 uM  SHAPE FACTOR=   3.771

PART NO:   187  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      733
ELEMENT CONCENTRATIONS:
Al: 16     Si: 52     S :  2     K :  3     Ca:  0     Cl:  0
Fe:  5     Ti:  5     Mg:  0     Na:  0     P :  4     Cu:  4
Ce:  5     Zn:  0     Ba:  0     Pb:  0
AVE DIA=         6.59 uM  MAX DIA=        13.62 uM  MIN DIA=        3.51 uM
AREA=       40.84 uM^2  PERIMETER=        33.83 uM  SHAPE FACTOR=   2.230

PART NO:   193  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      984
ELEMENT CONCENTRATIONS:
Al: 56     Si: 29     S :  2     K :  2     Ca:  2     Cl:  0
Fe:  0     Ti:  2     Mg:  0     Na:  0     P :  0     Cu:  1
Ce:  0     Zn:  0     Ba:  1     Pb:  0
AVE DIA=         5.27 uM  MAX DIA=         9.66 uM  MIN DIA=        3.51 uM
AREA=       26.55 uM^2  PERIMETER=        23.29 uM  SHAPE FACTOR=   1.625
```

```
PART NO:   205  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      458
ELEMENT CONCENTRATIONS:
Al: 62    Si: 14    S :  0    K :  1    Ca:  1    Cl:  0
Fe:  5    Ti:  0    Mg:  0    Na:  1    P :  4    Cu:  0
Ce:  3    Zn:  4    Ba:  0    Pb:  0
AVE DIA=        5.71 uM  MAX DIA=       10.10 uM  MIN DIA=        3.95 uM
AREA=      30.80 uM^2  PERIMETER=      30.76 uM  SHAPE FACTOR=   2.444

PART NO:   208  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      386
ELEMENT CONCENTRATIONS:
Al: 37    Si:  0    S :  3    K :  3    Ca:  0    Cl:  6
Fe:  8    Ti:  3    Mg:  4    Na:  3    P :  6    Cu:  0
Ce:  6    Zn:  2    Ba: 13    Pb:  0
AVE DIA=        7.03 uM  MAX DIA=       16.69 uM  MIN DIA=        3.51 uM
AREA=      52.91 uM^2  PERIMETER=      41.74 uM  SHAPE FACTOR=   2.620

PART NO:   214  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      455
ELEMENT CONCENTRATIONS:
Al: 38    Si: 33    S :  1    K :  0    Ca:  6    Cl:  0
Fe:  6    Ti:  1    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  6
AVE DIA=        7.03 uM  MAX DIA=       10.54 uM  MIN DIA=        5.27 uM
AREA=      40.74 uM^2  PERIMETER=      32.51 uM  SHAPE FACTOR=   2.064

PART NO:   215  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      725
ELEMENT CONCENTRATIONS:
Al:  3    Si:  8    S :  0    K :  1    Ca: 43    Cl:  0
Fe: 36    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  4    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       26.36 uM  MAX DIA=       45.26 uM  MIN DIA=       15.38 uM
AREA=     546.33 uM^2  PERIMETER=     137.10 uM  SHAPE FACTOR=   2.737

PART NO:   217  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      430
ELEMENT CONCENTRATIONS:
Al: 18    Si: 45    S :  0    K :  5    Ca:  6    Cl:  6
Fe: 10    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  5    Zn:  1    Ba:  0    Pb:  0
AVE DIA=        7.47 uM  MAX DIA=       11.42 uM  MIN DIA=        5.27 uM
AREA=      56.19 uM^2  PERIMETER=      39.11 uM  SHAPE FACTOR=   2.165

PART NO:   219  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      605
ELEMENT CONCENTRATIONS:
Al: 32    Si: 32    S :  9    K : 10    Ca:  1    Cl:  0
Fe:  3    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  1    Pb:  3
AVE DIA=       10.54 uM  MAX DIA=       13.62 uM  MIN DIA=        7.47 uM
AREA=     102.93 uM^2  PERIMETER=      49.21 uM  SHAPE FACTOR=   1.872
```

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LABEL: 85-197-P587-200-1100-0   500X                          PAGE:  10

PART NO:   220  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1498
ELEMENT CONCENTRATIONS:
Al: 35    Si: 47    S :  3    K :  0    Ca:  0    Cl:  1
Fe:  3    Ti:  4    Mg:  2    Na:  0    P :  0    Cu:  6
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        7.03 uM  MAX DIA=        9.66 uM  MIN DIA=        3.95 uM
AREA=       42.00 uM^2  PERIMETER=      34.71 uM  SHAPE FACTOR=   2.283

PART NO:   222  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     795
ELEMENT CONCENTRATIONS:
Al: 36    Si: 36    S :  2    K :  5    Ca:  2    Cl:  0
Fe:  1    Ti:  2    Mg:  4    Na:  0    P :  2    Cu:  0
Ce:  0    Zn:  0    Ba:  2    Pb:  2
AVE DIA=       24.16 uM  MAX DIA=       44.38 uM  MIN DIA=       12.74 uM
AREA=      495.06 uM^2  PERIMETER=     125.68 uM  SHAPE FACTOR=   2.538

PART NO:   225  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     270
ELEMENT CONCENTRATIONS:
Al: 36    Si: 24    S :  0    K :  1    Ca:  4    Cl:  3
Fe:  3    Ti:  0    Mg:  2    Na:  1    P :  0    Cu:  7
Ce:  0    Zn:  0    Ba:  0    Pb:  5
AVE DIA=       23.29 uM  MAX DIA=       60.64 uM  MIN DIA=       11.42 uM
AREA=      437.99 uM^2  PERIMETER=     183.69 uM  SHAPE FACTOR=   6.129

PART NO:   226  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1519
ELEMENT CONCENTRATIONS:
Al: 23    Si: 64    S :  1    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  3    Mg:  1    Na:  0    P :  1    Cu:  0
Ce:  1    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       22.41 uM  MAX DIA=       43.94 uM  MIN DIA=        9.66 uM
AREA=      415.60 uM^2  PERIMETER=     148.97 uM  SHAPE FACTOR=   4.240

PART NO:   228  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     387
ELEMENT CONCENTRATIONS:
Al: 34    Si: 25    S :  9    K : 12    Ca:  0    Cl:  4
Fe:  0    Ti:  0    Mg:  0    Na:  1    P : 12    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       11.86 uM  MAX DIA=       22.41 uM  MIN DIA=        5.27 uM
AREA=      134.31 uM^2  PERIMETER=      80.41 uM  SHAPE FACTOR=   3.831

PART NO:   230  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     793
ELEMENT CONCENTRATIONS:
Al: 37    Si: 38    S :  3    K :  3    Ca:  1    Cl:  0
Fe:  1    Ti:  4    Mg:  0    Na:  0    P :  0    Cu:  3
Ce:  2    Zn:  1    Ba:  2    Pb:  0
AVE DIA=       10.10 uM  MAX DIA=       17.57 uM  MIN DIA=        6.59 uM
AREA=       80.83 uM^2  PERIMETER=      51.85 uM  SHAPE FACTOR=   2.408
```

```
PART NO:   235  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1120
ELEMENT CONCENTRATIONS:
Al: 33    Si: 44    S :  2    K :  0    Ca:  1    Cl:  0
Fe:  0    Ti: 15    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        5.27 uM  MAX DIA=        6.15 uM  MIN DIA=        4.83 uM
AREA=      27.51 uM^2  PERIMETER=       20.65 uM  SHAPE FACTOR=   1.233

PART NO:   248  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     419
ELEMENT CONCENTRATIONS:
Al: 47    Si: 10    S :  2    K :  1    Ca:  6    Cl:  0
Fe: 14    Ti:  2    Mg:  0    Na:  1    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  4
AVE DIA=       25.92 uM  MAX DIA=       36.03 uM  MIN DIA=        7.91 uM
AREA=     557.72 uM^2  PERIMETER=      149.41 uM  SHAPE FACTOR=   3.184

PART NO:   249  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     509
ELEMENT CONCENTRATIONS:
Al: 32    Si: 33    S :  0    K :  0    Ca:  0    Cl:  6
Fe: 12    Ti:  7    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  4    Ba:  0    Pb:  0
AVE DIA=       25.04 uM  MAX DIA=       44.38 uM  MIN DIA=       10.54 uM
AREA=     560.91 uM^2  PERIMETER=      137.54 uM  SHAPE FACTOR=   2.683

PART NO:   258  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     434
ELEMENT CONCENTRATIONS:
Al: 43    Si: 17    S :  0    K : 11    Ca:  4    Cl:  7
Fe:  8    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  3
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=       14.06 uM  MAX DIA=       27.68 uM  MIN DIA=        7.47 uM
AREA=     129.10 uM^2  PERIMETER=       98.87 uM  SHAPE FACTOR=   6.025

PART NO:   259  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1390
ELEMENT CONCENTRATIONS:
Al: 55    Si: 24    S :  4    K :  0    Ca:  0    Cl:  0
Fe:  3    Ti:  2    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  4    Zn:  0    Ba:  3    Pb:  0
AVE DIA=       17.57 uM  MAX DIA=       24.16 uM  MIN DIA=       11.86 uM
AREA=     251.63 uM^2  PERIMETER=       89.64 uM  SHAPE FACTOR=   2.541

PART NO:   262  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     563
ELEMENT CONCENTRATIONS:
Al: 14    Si: 46    S :  0    K :  0    Ca:  1    Cl:  0
Fe: 13    Ti:  8    Mg:  1    Na:  3    P :  0    Cu:  0
Ce:  7    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       10.10 uM  MAX DIA=       36.91 uM  MIN DIA=        2.63 uM
AREA=     143.87 uM^2  PERIMETER=       89.64 uM  SHAPE FACTOR=   4.444
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LABEL: 85-197-P587-200-1100-0   500X                              PAGE:  12

PART NO:    264  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      321
ELEMENT CONCENTRATIONS:
Al: 24     Si: 31     S :  7     K :  0     Ca:  1     Cl: 13
Fe:  2     Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  8     Zn:  5     Ba:  5     Pb:  0
AVE DIA=         9.22 uM  MAX DIA=        20.21 uM  MIN DIA=        2.63 uM
AREA=      102.54 uM^2  PERIMETER=       55.37 uM  SHAPE FACTOR=   2.378

PART NO:    272  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      592
ELEMENT CONCENTRATIONS:
Al: 58     Si: 16     S :  0     K :  0     Ca:  0     Cl:  0
Fe:  9     Ti:  0     Mg:  0     Na:  0     P :  1     Cu:  2
Ce:  5     Zn:  0     Ba:  0     Pb:  4
AVE DIA=        10.98 uM  MAX DIA=        22.85 uM  MIN DIA=        4.83 uM
AREA=      110.75 uM^2  PERIMETER=       61.96 uM  SHAPE FACTOR=   2.758

PART NO:    273  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      814
ELEMENT CONCENTRATIONS:
Al: 46     Si: 30     S :  1     K :  6     Ca:  7     Cl:  1
Fe:  3     Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  2     Ba:  0     Pb:  0
AVE DIA=         5.27 uM  MAX DIA=        15.38 uM  MIN DIA=        2.63 uM
AREA=       28.19 uM^2  PERIMETER=       34.27 uM  SHAPE FACTOR=   3.315

PART NO:    276  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      707
ELEMENT CONCENTRATIONS:
Al: 51     Si: 13     S :  5     K :  0     Ca:  4     Cl:  1
Fe:  5     Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  5     Zn:  3     Ba:  7     Pb:  0
AVE DIA=        21.09 uM  MAX DIA=        39.11 uM  MIN DIA=        7.47 uM
AREA=      409.12 uM^2  PERIMETER=      117.33 uM  SHAPE FACTOR=   2.677

PART NO:    278  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      484
ELEMENT CONCENTRATIONS:
Al: 57     Si: 11     S : 15     K :  0     Ca:  1     Cl:  0
Fe:  2     Ti:  0     Mg:  2     Na:  0     P :  0     Cu:  5
Ce:  0     Zn:  2     Ba:  0     Pb:  0
AVE DIA=        17.13 uM  MAX DIA=        29.44 uM  MIN DIA=       10.98 uM
AREA=      203.35 uM^2  PERIMETER=      102.39 uM  SHAPE FACTOR=   4.102

PART NO:    279  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      514
ELEMENT CONCENTRATIONS:
Al: 54     Si: 23     S :  0     K :  7     Ca:  0     Cl:  0
Fe:  9     Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  4     Zn:  0     Ba:  0     Pb:  0
AVE DIA=        22.41 uM  MAX DIA=        33.83 uM  MIN DIA=       12.74 uM
AREA=      424.57 uM^2  PERIMETER=      104.15 uM  SHAPE FACTOR=   2.032
```

```
PART NO:   284  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      326
ELEMENT CONCENTRATIONS:
Al: 47    Si: 11    S :  0    K :  4    Ca:  1    Cl:  1
Fe:  0    Ti:  9    Mg:  0    Na:  0    P :  0    Cu: 10
Ce:  6    Zn:  3    Ba:  2    Pb:  0
AVE DIA=        14.06 uM  MAX DIA=        30.32 uM  MIN DIA=        5.71 uM
AREA=     221.99 uM^2  PERIMETER=        82.61 uM  SHAPE FACTOR=   2.446

PART NO:   292  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      362
ELEMENT CONCENTRATIONS:
Al: 53    Si: 16    S :  5    K :  2    Ca:  0    Cl:  7
Fe:  3    Ti:  0    Mg:  0    Na:  1    P :  2    Cu:  0
Ce:  0    Zn:  1    Ba:  1    Pb:  4
AVE DIA=        15.38 uM  MAX DIA=        30.32 uM  MIN DIA=        5.71 uM
AREA=     205.86 uM^2  PERIMETER=        86.57 uM  SHAPE FACTOR=   2.896

PART NO:   297  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      528
ELEMENT CONCENTRATIONS:
Al: 40    Si: 28    S :  7    K :  0    Ca:  0    Cl:  0
Fe: 10    Ti:  5    Mg:  2    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  1    Ba:  0    Pb:  1
AVE DIA=        33.03 uM  MAX DIA=        53.61 uM  MIN DIA=       26.36 uM
AREA=     890.66 uM^2  PERIMETER=       153.36 uM  SHAPE FACTOR=   2.101

PART NO:   303  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      531
ELEMENT CONCENTRATIONS:
Al: 53    Si:  7    S :  0    K :  0    Ca: 19    Cl:  6
Fe:  0    Ti:  1    Mg:  1    Na:  1    P :  0    Cu:  0
Ce:  0    Zn:  4    Ba:  0    Pb:  3
AVE DIA=        14.50 uM  MAX DIA=        21.53 uM  MIN DIA=       10.54 uM
AREA=     176.41 uM^2  PERIMETER=        79.54 uM  SHAPE FACTOR=   2.853

PART NO:   307  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      730
ELEMENT CONCENTRATIONS:
Al: 23    Si: 59    S :  0    K :  3    Ca:  0    Cl:  1
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  2    Cu:  0
Ce:  0    Zn:  0    Ba:  3    Pb:  3
AVE DIA=        13.18 uM  MAX DIA=        26.36 uM  MIN DIA=        9.66 uM
AREA=     132.38 uM^2  PERIMETER=        78.66 uM  SHAPE FACTOR=   3.719

PART NO:   318  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      590
ELEMENT CONCENTRATIONS:
Al: 28    Si: 53    S :  2    K :  0    Ca:  1    Cl:  3
Fe:  1    Ti:  0    Mg:  1    Na:  1    P :  0    Cu:  3
Ce:  4    Zn:  4    Ba:  0    Pb:  1
AVE DIA=        12.30 uM  MAX DIA=        24.16 uM  MIN DIA=        1.75 uM
AREA=     120.12 uM^2  PERIMETER=        82.61 uM  SHAPE FACTOR=   4.521
```

```
PART NO:   321  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      735
ELEMENT CONCENTRATIONS:
Al: 52    Si: 33    S :  1    K :  0    Ca:  0    Cl:  0
Fe:  3    Ti:  0    Mg:  0    Na:  1    P :  0    Cu:  3
Ce:  0    Zn:  2    Ba:  0    Pb:  1
AVE DIA=        25.04 uM  MAX DIA=       36.91 uM  MIN DIA=       16.25 uM
AREA=      524.99 uM^2  PERIMETER=      108.10 uM  SHAPE FACTOR=   1.771

PART NO:   322  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      445
ELEMENT CONCENTRATIONS:
Al: 43    Si: 29    S :  4    K :  0    Ca:  4    Cl:  0
Fe:  0    Ti:  3    Mg:  0    Na:  0    P :  3    Cu:  1
Ce:  0    Zn:  0    Ba:  5    Pb:  4
AVE DIA=         9.66 uM  MAX DIA=       36.91 uM  MIN DIA=        1.75 uM
AREA=      112.10 uM^2  PERIMETER=       89.64 uM  SHAPE FACTOR=   5.704

PART NO:   323  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      363
ELEMENT CONCENTRATIONS:
Al: 29    Si: 30    S :  2    K :  0    Ca:  8    Cl:  0
Fe:  1    Ti:  0    Mg:  1    Na:  0    P :  0    Cu:  0
Ce: 16    Zn:  1    Ba:  6    Pb:  3
AVE DIA=         5.71 uM  MAX DIA=       18.89 uM  MIN DIA=        2.63 uM
AREA=       52.52 uM^2  PERIMETER=       48.77 uM  SHAPE FACTOR=   3.604

PART NO:   324  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      591
ELEMENT CONCENTRATIONS:
Al: 44    Si: 19    S :  6    K :  7    Ca:  0    Cl:  3
Fe:  0    Ti:  2    Mg:  2    Na:  2    P :  1    Cu:  2
Ce:  0    Zn:  1    Ba:  3    Pb:  2
AVE DIA=         7.03 uM  MAX DIA=       15.82 uM  MIN DIA=        3.51 uM
AREA=       55.61 uM^2  PERIMETER=       43.50 uM  SHAPE FACTOR=   2.707

PART NO:   329  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      366
ELEMENT CONCENTRATIONS:
Al: 25    Si: 19    S :  9    K :  0    Ca: 10    Cl:  0
Fe: 13    Ti:  0    Mg:  2    Na:  0    P : 11    Cu:  0
Ce:  1    Zn:  3    Ba:  0    Pb:  1
AVE DIA=        10.54 uM  MAX DIA=       21.97 uM  MIN DIA=        4.39 uM
AREA=       82.55 uM^2  PERIMETER=       69.43 uM  SHAPE FACTOR=   4.646

PART NO:   331  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      449
ELEMENT CONCENTRATIONS:
Al: 41    Si: 25    S :  1    K :  0    Ca:  5    Cl:  0
Fe: 10    Ti:  3    Mg:  3    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  8    Pb:  0
AVE DIA=         8.78 uM  MAX DIA=       21.53 uM  MIN DIA=        1.75 uM
AREA=      102.35 uM^2  PERIMETER=       79.10 uM  SHAPE FACTOR=   4.864
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```
PART NO:   336  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       341
ELEMENT CONCENTRATIONS:
Al: 51    Si: 12    S :  1    K :  0    Ca:  8    Cl:  7
Fe:  1    Ti:  2    Mg:  2    Na:  0    P :  0    Cu:  4
Ce:  0    Zn:  0    Ba:  0    Pb:  5
AVE DIA=       17.57 uM  MAX DIA=       39.55 uM  MIN DIA=        7.03 uM
AREA=     306.09 uM^2  PERIMETER=      101.07 uM  SHAPE FACTOR=   2.655

PART NO:   338  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       514
ELEMENT CONCENTRATIONS:
Al: 50    Si: 30    S :  1    K :  0    Ca:  1    Cl:  0
Fe:  2    Ti:  3    Mg:  0    Na:  3    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  2    Pb:  0
AVE DIA=       28.56 uM  MAX DIA=       42.62 uM  MIN DIA=       11.42 uM
AREA=     660.94 uM^2  PERIMETER=      153.80 uM  SHAPE FACTOR=   2.847

PART NO:   342  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       522
ELEMENT CONCENTRATIONS:
Al: 24    Si: 63    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  5    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  0    Zn:  2    Ba:  0    Pb:  0
AVE DIA=       12.74 uM  MAX DIA=       27.24 uM  MIN DIA=        7.03 uM
AREA=     146.09 uM^2  PERIMETER=       91.84 uM  SHAPE FACTOR=   4.594

PART NO:   343  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       687
ELEMENT CONCENTRATIONS:
Al: 45    Si: 32    S :  3    K :  4    Ca:  4    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  0    Zn:  3    Ba:  0    Pb:  0
AVE DIA=       21.09 uM  MAX DIA=       62.84 uM  MIN DIA=        7.47 uM
AREA=     502.10 uM^2  PERIMETER=      139.30 uM  SHAPE FACTOR=   3.075

PART NO:   355  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       718
ELEMENT CONCENTRATIONS:
Al: 39    Si: 44    S :  1    K :  0    Ca:  4    Cl:  0
Fe:  4    Ti:  2    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  1    Pb:  0
AVE DIA=        5.27 uM  MAX DIA=       14.50 uM  MIN DIA=        1.75 uM
AREA=      34.47 uM^2  PERIMETER=       41.30 uM  SHAPE FACTOR=   3.938

PART NO:   373  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       255
ELEMENT CONCENTRATIONS:
Al: 34    Si: 14    S :  1    K : 18    Ca:  0    Cl:  0
Fe: 17    Ti:  3    Mg:  0    Na:  0    P :  0    Cu:  4
Ce:  1    Zn:  0    Ba:  0    Pb:  4
AVE DIA=        6.15 uM  MAX DIA=        9.66 uM  MIN DIA=        3.95 uM
AREA=      36.78 uM^2  PERIMETER=       32.95 uM  SHAPE FACTOR=   2.349
```

```
PART NO:   379  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      616
ELEMENT CONCENTRATIONS:
Al: 62    Si:  5    S :  2    K :  0    Ca:  3    Cl:  0
Fe:  0    Ti:  0    Mg:  3    Na:  1    P :  3    Cu:  1
Ce:  2    Zn:  4    Ba:  7    Pb:  0
AVE DIA=       29.00 uM  MAX DIA=       58.88 uM  MIN DIA=       18.45 uM
AREA=      803.95 uM^2  PERIMETER=      169.18 uM  SHAPE FACTOR=   2.833

PART NO:   385  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      560
ELEMENT CONCENTRATIONS:
Al: 51    Si:  5    S :  3    K :  0    Ca:  0    Cl:  5
Fe:  8    Ti:  3    Mg:  2    Na:  1    P :  2    Cu:  2
Ce:  3    Zn:  3    Ba:  4    Pb:  1
AVE DIA=        9.22 uM  MAX DIA=       14.50 uM  MIN DIA=        4.83 uM
AREA=       72.70 uM^2  PERIMETER=       52.29 uM  SHAPE FACTOR=   2.992

PART NO:   386  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      672
ELEMENT CONCENTRATIONS:
Al: 37    Si: 32    S :  1    K :  0    Ca:  1    Cl:  3
Fe:  1    Ti:  5    Mg:  2    Na:  1    P :  0    Cu:  0
Ce:  8    Zn:  0    Ba:  4    Pb:  0
AVE DIA=        7.91 uM  MAX DIA=       19.33 uM  MIN DIA=        4.83 uM
AREA=       49.72 uM^2  PERIMETER=       47.46 uM  SHAPE FACTOR=   3.604

PART NO:   392  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      781
ELEMENT CONCENTRATIONS:
Al: 22    Si: 54    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  5    Ti:  0    Mg:  0    Na:  0    P :  1    Cu:  3
Ce:  3    Zn:  2    Ba:  4    Pb:  0
AVE DIA=        7.03 uM  MAX DIA=       15.38 uM  MIN DIA=        3.51 uM
AREA=       50.11 uM^2  PERIMETER=       45.70 uM  SHAPE FACTOR=   3.316

PART NO:   393  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      601
ELEMENT CONCENTRATIONS:
Al: 12    Si: 60    S :  6    K :  0    Ca:  5    Cl:  0
Fe:  3    Ti:  1    Mg:  0    Na:  3    P :  3    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  4
AVE DIA=       15.82 uM  MAX DIA=       23.29 uM  MIN DIA=        4.39 uM
AREA=      183.55 uM^2  PERIMETER=       88.76 uM  SHAPE FACTOR=   3.415

PART NO:   397  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      249
ELEMENT CONCENTRATIONS:
Al: 58    Si:  0    S : 14    K :  0    Ca:  6    Cl:  5
Fe:  0    Ti:  0    Mg:  0    Na:  2    P :  0    Cu:  0
Ce:  4    Zn:  4    Ba:  0    Pb:  3
AVE DIA=        5.71 uM  MAX DIA=       12.74 uM  MIN DIA=        0.87 uM
AREA=       40.84 uM^2  PERIMETER=       34.27 uM  SHAPE FACTOR=   2.288
```

```
PART NO:   399  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      584
ELEMENT CONCENTRATIONS:
Al: 52    Si: 10    S :  6    K :  2    Ca:  3    Cl:  6
Fe:  5    Ti:  0    Mg:  2    Na:  1    P :  0    Cu:  4
Ce:  4    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       11.86 uM  MAX DIA=       13.62 uM  MIN DIA=        9.22 uM
AREA=     110.36 uM^2  PERIMETER=      49.21 uM  SHAPE FACTOR=   1.746

PART NO:   401  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      434
ELEMENT CONCENTRATIONS:
Al: 49    Si: 20    S :  3    K :  0    Ca:  3    Cl:  0
Fe:  2    Ti:  7    Mg:  0    Na:  0    P :  0    Cu:  3
Ce:  0    Zn:  5    Ba:  1    Pb:  0
AVE DIA=       10.98 uM  MAX DIA=       14.50 uM  MIN DIA=        7.47 uM
AREA=     112.00 uM^2  PERIMETER=      56.25 uM  SHAPE FACTOR=   2.247

PART NO:   404  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      388
ELEMENT CONCENTRATIONS:
Al: 19    Si: 58    S :  0    K :  3    Ca:  7    Cl:  2
Fe:  0    Ti:  5    Mg:  2    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       14.06 uM  MAX DIA=       34.27 uM  MIN DIA=        5.71 uM
AREA=     180.46 uM^2  PERIMETER=      88.76 uM  SHAPE FACTOR=   3.474

PART NO:   406  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      326
ELEMENT CONCENTRATIONS:
Al: 12    Si: 36    S :  3    K :  1    Ca:  1    Cl: 13
Fe:  5    Ti:  0    Mg:  0    Na:  2    P :  9    Cu:  0
Ce:  2    Zn:  0    Ba:  3    Pb:  7
AVE DIA=        7.03 uM  MAX DIA=       13.62 uM  MIN DIA=        1.31 uM
AREA=      46.15 uM^2  PERIMETER=      39.99 uM  SHAPE FACTOR=   2.756

PART NO:   407  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      644
ELEMENT CONCENTRATIONS:
Al: 10    Si: 48    S :  0    K : 11    Ca:  3    Cl:  6
Fe:  0    Ti:  4    Mg:  5    Na:  0    P :  0    Cu:  3
Ce:  0    Zn:  0    Ba:  4    Pb:  0
AVE DIA=        8.34 uM  MAX DIA=       19.33 uM  MIN DIA=        3.51 uM
AREA=      91.53 uM^2  PERIMETER=      56.25 uM  SHAPE FACTOR=   2.750

PART NO:   414  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      342
ELEMENT CONCENTRATIONS:
Al: 47    Si: 30    S :  1    K :  0    Ca:  3    Cl:  4
Fe:  2    Ti:  0    Mg:  4    Na:  2    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  2    Pb:  0
AVE DIA=        6.59 uM  MAX DIA=       10.10 uM  MIN DIA=        3.51 uM
AREA=      64.11 uM^2  PERIMETER=      35.15 uM  SHAPE FACTOR=   1.533
```

```
PART NO:    417  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      700
ELEMENT CONCENTRATIONS:
Al: 17    Si: 55    S : 11    K :  0    Ca:  3    Cl:  0
Fe:  3    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  2
Ce:  0    Zn:  0    Ba:  1    Pb:  1
AVE DIA=        5.27 uM  MAX DIA=       6.59 uM  MIN DIA=        3.51 uM
AREA=       27.13 uM^2  PERIMETER=      25.48 uM  SHAPE FACTOR=   1.905

PART NO:    422  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      449
ELEMENT CONCENTRATIONS:
Al: 41    Si: 32    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  6    Mg:  0    Na:  1    P :  4    Cu:  4
Ce:  7    Zn:  0    Ba:  0    Pb:  1
AVE DIA=       21.97 uM  MAX DIA=      47.90 uM  MIN DIA=        4.83 uM
AREA=      440.11 uM^2  PERIMETER=     137.54 uM  SHAPE FACTOR=   3.420

PART NO:    424  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      463
ELEMENT CONCENTRATIONS:
Al: 19    Si: 47    S : 11    K :  5    Ca:  0    Cl:  2
Fe:  3    Ti:  1    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  3    Zn:  1    Ba:  0    Pb:  2
AVE DIA=       10.10 uM  MAX DIA=      26.36 uM  MIN DIA=        4.83 uM
AREA=       85.64 uM^2  PERIMETER=      74.26 uM  SHAPE FACTOR=   5.124

PART NO:    426  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      931
ELEMENT CONCENTRATIONS:
Al: 62    Si: 17    S :  0    K :  0    Ca:  2    Cl:  3
Fe:  2    Ti:  2    Mg:  3    Na:  0    P :  1    Cu:  0
Ce:  4    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       13.62 uM  MAX DIA=      17.57 uM  MIN DIA=       11.42 uM
AREA=      147.06 uM^2  PERIMETER=      51.85 uM  SHAPE FACTOR=   1.454

PART NO:    429  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      756
ELEMENT CONCENTRATIONS:
Al: 11    Si: 69    S :  1    K :  1    Ca:  0    Cl:  2
Fe:  4    Ti:  0    Mg:  3    Na:  0    P :  0    Cu:  0
Ce:  4    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       19.77 uM  MAX DIA=      26.36 uM  MIN DIA=       15.38 uM
AREA=      394.15 uM^2  PERIMETER=      84.37 uM  SHAPE FACTOR=   1.437

PART NO:    431  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      749
ELEMENT CONCENTRATIONS:
Al: 15    Si: 69    S :  0    K :  0    Ca:  3    Cl:  3
Fe:  4    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  1    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        9.22 uM  MAX DIA=      12.74 uM  MIN DIA=        6.59 uM
AREA=       79.17 uM^2  PERIMETER=      43.06 uM  SHAPE FACTOR=   1.863
```

```
PART NO:   434  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      574
ELEMENT CONCENTRATIONS:
Al: 45    Si: 17    S : 10    K :  7    Ca:  1    Cl:  2
Fe:  7    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  4
Ce:  0    Zn:  1    Ba:  0    Pb:  2
AVE DIA=        9.66 uM  MAX DIA=       20.21 uM  MIN DIA=        3.51 uM
AREA=       79.37 uM^2  PERIMETER=       76.46 uM  SHAPE FACTOR=   5.861

PART NO:   438  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      508
ELEMENT CONCENTRATIONS:
Al: 36    Si: 21    S :  2    K :  2    Ca:  2    Cl:  0
Fe: 12    Ti:  7    Mg:  0    Na:  3    P :  0    Cu:  1
Ce:  0    Zn:  0    Ba:  5    Pb:  2
AVE DIA=       12.30 uM  MAX DIA=       18.01 uM  MIN DIA=        9.22 uM
AREA=      136.53 uM^2  PERIMETER=       65.91 uM  SHAPE FACTOR=   2.532

PART NO:   439  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      523
ELEMENT CONCENTRATIONS:
Al: 43    Si: 11    S :  4    K :  0    Ca:  8    Cl:  0
Fe:  8    Ti:  2    Mg:  4    Na:  0    P :  0    Cu:  0
Ce: 10    Zn:  2    Ba:  3    Pb:  0
AVE DIA=       11.42 uM  MAX DIA=       27.24 uM  MIN DIA=        4.83 uM
AREA=      110.65 uM^2  PERIMETER=       90.08 uM  SHAPE FACTOR=   5.835

PART NO:   440  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      917
ELEMENT CONCENTRATIONS:
Al: 14    Si: 28    S :  0    K :  0    Ca: 22    Cl:  5
Fe:  0    Ti:  4    Mg:  2    Na:  2    P :  9    Cu:  1
Ce:  0    Zn:  2    Ba:  5    Pb:  0
AVE DIA=       14.94 uM  MAX DIA=       31.20 uM  MIN DIA=        6.59 uM
AREA=      212.81 uM^2  PERIMETER=       85.69 uM  SHAPE FACTOR=   2.745

PART NO:   442  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      727
ELEMENT CONCENTRATIONS:
Al: 50    Si: 27    S :  3    K :  0    Ca:  3    Cl:  3
Fe:  5    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  3
AVE DIA=       19.33 uM  MAX DIA=       27.24 uM  MIN DIA=       12.74 uM
AREA=      311.01 uM^2  PERIMETER=       85.25 uM  SHAPE FACTOR=   1.859

PART NO:   443  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      904
ELEMENT CONCENTRATIONS:
Al: 63    Si: 20    S :  2    K :  0    Ca:  2    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  1
Ce:  2    Zn:  1    Ba:  4    Pb:  0
AVE DIA=       17.57 uM  MAX DIA=       36.03 uM  MIN DIA=        9.66 uM
AREA=      246.99 uM^2  PERIMETER=       99.31 uM  SHAPE FACTOR=   3.177
```

```
PART NO:   446  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      534
ELEMENT CONCENTRATIONS:
Al: 29    Si: 43    S :  6    K :  2    Ca:  0    Cl:  0
Fe:  2    Ti:  4    Mg:  0    Na:  1    P :  1    Cu:  4
Ce:  0    Zn:  0    Ba:  0    Pb:  4
AVE DIA=        6.15 uM  MAX DIA=       11.86 uM  MIN DIA=        3.51 uM
AREA=       35.92 uM^2  PERIMETER=       27.68 uM  SHAPE FACTOR=   1.697

PART NO:   450  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1257
ELEMENT CONCENTRATIONS:
Al: 24    Si: 69    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       10.54 uM  MAX DIA=       13.62 uM  MIN DIA=        7.47 uM
AREA=       86.71 uM^2  PERIMETER=       43.50 uM  SHAPE FACTOR=   1.736

PART NO:   451  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      738
ELEMENT CONCENTRATIONS:
Al:  6    Si:  7    S :  0    K :  0    Ca: 39    Cl:  0
Fe:  4    Ti:  0    Mg:  0    Na:  0    P : 27    Cu:  0
Ce:  1    Zn:  1    Ba:  6    Pb:  1
AVE DIA=        8.78 uM  MAX DIA=       22.41 uM  MIN DIA=        5.27 uM
AREA=       67.01 uM^2  PERIMETER=       55.37 uM  SHAPE FACTOR=   3.640

PART NO:   452  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      321
ELEMENT CONCENTRATIONS:
Al: 54    Si:  9    S :  0    K :  8    Ca:  5    Cl:  5
Fe:  0    Ti:  3    Mg:  1    Na:  0    P :  3    Cu:  0
Ce:  0    Zn:  0    Ba:  5    Pb:  0
AVE DIA=       18.45 uM  MAX DIA=       32.95 uM  MIN DIA=       12.74 uM
AREA=      322.41 uM^2  PERIMETER=       91.84 uM  SHAPE FACTOR=   2.081

PART NO:   453  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      779
ELEMENT CONCENTRATIONS:
Al: 12    Si: 65    S :  6    K :  0    Ca:  3    Cl:  4
Fe:  3    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=        7.03 uM  MAX DIA=       10.98 uM  MIN DIA=        5.71 uM
AREA=       44.61 uM^2  PERIMETER=       34.71 uM  SHAPE FACTOR=   2.149

PART NO:   454  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      490
ELEMENT CONCENTRATIONS:
Al: 12    Si: 53    S :  7    K : 10    Ca:  0    Cl:  0
Fe:  8    Ti:  3    Mg:  4    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        5.27 uM  MAX DIA=       11.42 uM  MIN DIA=        3.07 uM
AREA=       30.31 uM^2  PERIMETER=       27.24 uM  SHAPE FACTOR=   1.948
```

```
PART NO:    459  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       403
ELEMENT CONCENTRATIONS:
Al: 31      Si: 45     S : 12     K :  5     Ca:  0     Cl:  0
Fe:  0      Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  3
Ce:  0      Zn:  0     Ba:  0     Pb:  0
AVE DIA=         6.59 uM  MAX DIA=        14.50 uM  MIN DIA=        3.51 uM
AREA=        43.35 uM^2  PERIMETER=       40.42 uM  SHAPE FACTOR=   2.999

PART NO:    461  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       835
ELEMENT CONCENTRATIONS:
Al: 33      Si:  1     S :  1     K :  0     Ca: 40     Cl:  0
Fe:  0      Ti:  0     Mg:  0     Na:  0     P : 13     Cu:  0
Ce:  2      Zn:  0     Ba:  4     Pb:  0
AVE DIA=        15.82 uM  MAX DIA=        35.15 uM  MIN DIA=        6.15 uM
AREA=       256.17 uM^2  PERIMETER=       98.87 uM  SHAPE FACTOR=   3.036

PART NO:    462  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       690
ELEMENT CONCENTRATIONS:
Al:  2      Si: 79     S :  0     K :  0     Ca:  0     Cl:  5
Fe:  5      Ti:  0     Mg:  0     Na:  1     P :  1     Cu:  0
Ce:  2      Zn:  0     Ba:  1     Pb:  0
AVE DIA=        11.42 uM  MAX DIA=        24.16 uM  MIN DIA=        6.59 uM
AREA=       130.74 uM^2  PERIMETER=       80.41 uM  SHAPE FACTOR=   3.935

PART NO:    464  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       337
ELEMENT CONCENTRATIONS:
Al:  4      Si: 57     S :  0     K :  3     Ca: 13     Cl:  5
Fe:  5      Ti:  2     Mg:  3     Na:  0     P :  1     Cu:  0
Ce:  0      Zn:  0     Ba:  0     Pb:  2
AVE DIA=        10.98 uM  MAX DIA=        18.45 uM  MIN DIA=        6.59 uM
AREA=       154.59 uM^2  PERIMETER=       59.76 uM  SHAPE FACTOR=   1.838

PART NO:    468  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       438
ELEMENT CONCENTRATIONS:
Al: 39      Si: 31     S :  0     K :  5     Ca:  5     Cl:  0
Fe:  4      Ti:  0     Mg:  2     Na:  0     P :  0     Cu:  4
Ce:  2      Zn:  2     Ba:  0     Pb:  1
AVE DIA=        10.54 uM  MAX DIA=        19.33 uM  MIN DIA=        3.51 uM
AREA=       105.44 uM^2  PERIMETER=       72.94 uM  SHAPE FACTOR=   4.015

PART NO:    469  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       263
ELEMENT CONCENTRATIONS:
Al: 13      Si: 52     S :  0     K :  0     Ca:  1     Cl:  4
Fe:  8      Ti:  2     Mg:  3     Na:  0     P :  0     Cu:  0
Ce:  7      Zn:  0     Ba:  3     Pb:  0
AVE DIA=         5.27 uM  MAX DIA=        10.54 uM  MIN DIA=        1.75 uM
AREA=        35.72 uM^2  PERIMETER=       29.88 uM  SHAPE FACTOR=   1.988
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```
PART NO:   473  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       536
ELEMENT CONCENTRATIONS:
Al: 16    Si: 46    S : 15    K :  0    Ca:  0    Cl:  0
Fe:  4    Ti:  9    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  2    Ba:  0    Pb:  1
AVE DIA=        8.78 uM  MAX DIA=       16.69 uM  MIN DIA=        6.15 uM
AREA=       65.66 uM^2  PERIMETER=       45.70 uM  SHAPE FACTOR=   2.531

PART NO:   478  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       315
ELEMENT CONCENTRATIONS:
Al: 43    Si: 23    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  0    Mg:  2    Na:  0    P :  8    Cu:  8
Ce:  0    Zn:  0    Ba:  5    Pb:  6
AVE DIA=       15.38 uM  MAX DIA=       32.51 uM  MIN DIA=        8.78 uM
AREA=      179.02 uM^2  PERIMETER=       90.96 uM  SHAPE FACTOR=   3.677

PART NO:   487  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      1252
ELEMENT CONCENTRATIONS:
Al: 25    Si: 49    S :  3    K :  0    Ca:  0    Cl:  1
Fe:  0    Ti: 14    Mg:  0    Na:  0    P :  0    Cu:  1
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       14.06 uM  MAX DIA=       27.24 uM  MIN DIA=        6.59 uM
AREA=      135.94 uM^2  PERIMETER=       87.01 uM  SHAPE FACTOR=   3.862

PART NO:   488  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       423
ELEMENT CONCENTRATIONS:
Al: 27    Si: 53    S :  8    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  3    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  4    Zn:  0    Ba:  3    Pb:  0
AVE DIA=        9.66 uM  MAX DIA=       19.33 uM  MIN DIA=        5.71 uM
AREA=       80.72 uM^2  PERIMETER=       47.90 uM  SHAPE FACTOR=   2.261

PART NO:   489  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      1178
ELEMENT CONCENTRATIONS:
Al: 63    Si: 25    S :  4    K :  0    Ca:  1    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  1
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=       11.86 uM  MAX DIA=       17.57 uM  MIN DIA=        7.47 uM
AREA=      117.70 uM^2  PERIMETER=       51.41 uM  SHAPE FACTOR=   1.787

PART NO:   493  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       532
ELEMENT CONCENTRATIONS:
Al: 24    Si: 34    S :  7    K :  2    Ca:  0    Cl:  5
Fe:  6    Ti:  0    Mg:  2    Na:  0    P :  0    Cu:  0
Ce:  9    Zn:  2    Ba:  0    Pb:  3
AVE DIA=        7.91 uM  MAX DIA=       18.45 uM  MIN DIA=        1.75 uM
AREA=       75.99 uM^2  PERIMETER=       47.02 uM  SHAPE FACTOR=   2.315
```

```
PART NO:   497  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      407
ELEMENT CONCENTRATIONS:
Al: 30    Si: 49    S :  0    K :  0    Ca:  0    Cl:  1
Fe:  0    Ti:  0    Mg:  8    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  5    Pb:  0
AVE DIA=       14.06 uM  MAX DIA=       35.15 uM  MIN DIA=        1.75 uM
AREA=     227.10 uM^2  PERIMETER=       92.72 uM  SHAPE FACTOR=   3.012

PART NO:   498  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      810
ELEMENT CONCENTRATIONS:
Al: 53    Si: 20    S :  0    K :  1    Ca:  0    Cl:  4
Fe:  2    Ti:  5    Mg:  1    Na:  1    P :  1    Cu:  0
Ce:  0    Zn:  2    Ba:  0    Pb:  2
AVE DIA=       15.82 uM  MAX DIA=       21.53 uM  MIN DIA=       11.86 uM
AREA=     201.80 uM^2  PERIMETER=       61.08 uM  SHAPE FACTOR=   1.471

PART NO:   499  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      527
ELEMENT CONCENTRATIONS:
Al: 43    Si: 31    S :  4    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  0    Mg:  5    Na:  1    P :  6    Cu:  0
Ce:  0    Zn:  0    Ba:  5    Pb:  0
AVE DIA=       14.06 uM  MAX DIA=       23.29 uM  MIN DIA=        7.47 uM
AREA=     180.37 uM^2  PERIMETER=       66.35 uM  SHAPE FACTOR=   1.942

PART NO:   500  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      621
ELEMENT CONCENTRATIONS:
Al: 50    Si: 24    S :  4    K :  0    Ca:  3    Cl:  0
Fe:  0    Ti:  0    Mg:  6    Na:  1    P :  2    Cu:  0
Ce:  0    Zn:  3    Ba:  2    Pb:  0
AVE DIA=        7.91 uM  MAX DIA=       12.30 uM  MIN DIA=        3.51 uM
AREA=      53.88 uM^2  PERIMETER=       43.94 uM  SHAPE FACTOR=   2.851

PART NO:   503  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      351
ELEMENT CONCENTRATIONS:
Al: 15    Si: 45    S : 10    K :  1    Ca:  0    Cl:  0
Fe:  9    Ti:  2    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  7    Pb:  4
AVE DIA=        9.66 uM  MAX DIA=       17.13 uM  MIN DIA=        3.95 uM
AREA=      96.26 uM^2  PERIMETER=       50.97 uM  SHAPE FACTOR=   2.147

PART NO:   508  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      473
ELEMENT CONCENTRATIONS:
Al: 30    Si: 23    S : 11    K :  0    Ca:  4    Cl:  0
Fe:  1    Ti:  3    Mg:  4    Na:  2    P :  7    Cu:  0
Ce:  2    Zn:  4    Ba:  3    Pb:  0
AVE DIA=       18.01 uM  MAX DIA=       30.32 uM  MIN DIA=        5.71 uM
AREA=     248.54 uM^2  PERIMETER=       96.67 uM  SHAPE FACTOR=   2.992
```

```
PART NO:   511  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     335
ELEMENT CONCENTRATIONS:
Al: 17    Si: 43    S :  2    K :  2    Ca:  2    Cl:  5
Fe:  7    Ti:  0    Mg:  3    Na:  0    P :  3    Cu:  0
Ce:  5    Zn:  0    Ba:  4    Pb:  0
AVE DIA=        6.59 uM  MAX DIA=       10.54 uM  MIN DIA=        3.51 uM
AREA=       36.59 uM^2  PERIMETER=      38.23 uM  SHAPE FACTOR=   3.178

PART NO:   514  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     497
ELEMENT CONCENTRATIONS:
Al: 36    Si: 23    S :  1    K :  4    Ca:  0    Cl:  0
Fe:  9    Ti:  0    Mg:  1    Na:  3    P :  2    Cu:  0
Ce: 10    Zn:  0    Ba:  0    Pb:  5
AVE DIA=       12.74 uM  MAX DIA=       35.15 uM  MIN DIA=        4.39 uM
AREA=      219.76 uM^2  PERIMETER=      83.05 uM  SHAPE FACTOR=   2.497

PART NO:   518  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     875
ELEMENT CONCENTRATIONS:
Al: 29    Si: 51    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  5    Ti:  4    Mg:  0    Na:  0    P :  4    Cu:  0
Ce:  0    Zn:  0    Ba:  1    Pb:  2
AVE DIA=        7.91 uM  MAX DIA=        9.66 uM  MIN DIA=        5.27 uM
AREA=       52.43 uM^2  PERIMETER=      30.76 uM  SHAPE FACTOR=   1.436

PART NO:   519  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     414
ELEMENT CONCENTRATIONS:
Al: 48    Si: 11    S :  5    K :  0    Ca:  0    Cl:  1
Fe: 19    Ti:  2    Mg:  0    Na:  0    P :  0    Cu:  8
Ce:  3    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       24.16 uM  MAX DIA=       39.11 uM  MIN DIA=       16.69 uM
AREA=      497.57 uM^2  PERIMETER=     105.46 uM  SHAPE FACTOR=   1.778

PART NO:   527  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     527
ELEMENT CONCENTRATIONS:
Al: 58    Si:  8    S :  2    K :  2    Ca:  2    Cl:  5
Fe:  4    Ti:  0    Mg:  5    Na:  0    P :  0    Cu:  2
Ce:  4    Zn:  2    Ba:  1    Pb:  0
AVE DIA=       19.33 uM  MAX DIA=       35.15 uM  MIN DIA=        6.15 uM
AREA=      296.24 uM^2  PERIMETER=     116.89 uM  SHAPE FACTOR=   3.670

PART NO:   528  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     505
ELEMENT CONCENTRATIONS:
Al:  4    Si: 58    S :  6    K :  0    Ca:  0    Cl:  3
Fe:  4    Ti:  6    Mg:  5    Na:  1    P :  0    Cu:  0
Ce:  6    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        6.15 uM  MAX DIA=       10.54 uM  MIN DIA=        3.51 uM
AREA=       39.39 uM^2  PERIMETER=      29.88 uM  SHAPE FACTOR=   1.803
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LABEL: 85-197-P587-200-1100-0   500X

PART NO:   529  DATA BASE NO: 1    NAME: UNKNOWN                 PAGE:  25
TOTAL XRAY COUNTS:      665
ELEMENT CONCENTRATIONS:
Al: 54     Si: 10     S :  0     K :  0     Ca:  3     Cl:  4
Fe:  6     Ti:  0     Mg:  0     Na:  0     P :  6     Cu:  0
Ce:  0     Zn:  3     Ba:  0     Pb:  0
AVE DIA=         5.71 uM  MAX DIA=         9.66 uM  MIN DIA=          1.75 uM
AREA=      31.18 uM^2  PERIMETER=         40.42 uM  SHAPE FACTOR=   4.170
PART NO:   530  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      324
ELEMENT CONCENTRATIONS:
Al: 39     Si: 15     S : 12     K :  0     Ca:  0     Cl:  4
Fe:  8     Ti:  0     Mg:  0     Na:  3     P :  0     Cu:  2
Ce: 10     Zn:  1     Ba:  0     Pb:  0
AVE DIA=         8.34 uM  MAX DIA=        13.62 uM  MIN DIA=          3.51 uM
AREA=      68.36 uM^2  PERIMETER=         41.30 uM  SHAPE FACTOR=   1.986
PART NO:   532  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      535
ELEMENT CONCENTRATIONS:
Al: 62     Si: 16     S :  2     K :  0     Ca:  0     Cl:  4
Fe:  0     Ti:  1     Mg:  2     Na:  0     P :  0     Cu:  5
Ce:  2     Zn:  0     Ba:  0     Pb:  2
AVE DIA=         9.22 uM  MAX DIA=        14.50 uM  MIN DIA=          4.83 uM
AREA=      74.93 uM^2  PERIMETER=         46.14 uM  SHAPE FACTOR=   2.260
PART NO:   534  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      441
ELEMENT CONCENTRATIONS:
Al: 45     Si: 12     S :  1     K :  0     Ca:  8     Cl:  3
Fe:  9     Ti:  2     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  4     Zn:  5     Ba:  5     Pb:  0
AVE DIA=        22.41 uM  MAX DIA=        40.86 uM  MIN DIA=          8.78 uM
AREA=     492.83 uM^2  PERIMETER=        138.86 uM  SHAPE FACTOR=   3.113
PART NO:   535  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1319
ELEMENT CONCENTRATIONS:
Al: 34     Si:  0     S :  0     K :  0     Ca: 33     Cl:  0
Fe:  2     Ti:  1     Mg:  0     Na:  0     P : 18     Cu:  0
Ce:  1     Zn:  0     Ba:  3     Pb:  2
AVE DIA=        10.10 uM  MAX DIA=        29.44 uM  MIN DIA=          5.71 uM
AREA=      89.99 uM^2  PERIMETER=         65.91 uM  SHAPE FACTOR=   3.841
PART NO:   537  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      259
ELEMENT CONCENTRATIONS:
Al: 28     Si: 32     S :  3     K :  0     Ca: 20     Cl:  4
Fe:  3     Ti:  1     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  1     Ba:  2     Pb:  0
AVE DIA=        17.57 uM  MAX DIA=        32.08 uM  MIN DIA=          3.51 uM
AREA=     288.03 uM^2  PERIMETER=         97.55 uM  SHAPE FACTOR=   2.629
```

```
PART NO:   543  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      382
ELEMENT CONCENTRATIONS:
Al: 52    Si:  0    S :  0    K : 13    Ca:  2    Cl:  0
Fe:  6    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce: 13    Zn:  4    Ba:  4    Pb:  0
AVE DIA=       20.21 uM  MAX DIA=      28.12 uM  MIN DIA=      14.50 uM
AREA=     330.42 uM^2  PERIMETER=     80.41 uM  SHAPE FACTOR=   1.557

PART NO:   547  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      519
ELEMENT CONCENTRATIONS:
Al: 30    Si: 26    S :  8    K :  1    Ca:  1    Cl:  5
Fe:  0    Ti:  0    Mg:  5    Na:  0    P :  8    Cu:  1
Ce:  0    Zn:  2    Ba:  2    Pb:  4
AVE DIA=       10.10 uM  MAX DIA=      17.57 uM  MIN DIA=       4.83 uM
AREA=      91.15 uM^2  PERIMETER=     57.12 uM  SHAPE FACTOR=   2.848

PART NO:   550  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      274
ELEMENT CONCENTRATIONS:
Al: 35    Si: 29    S :  0    K :  0    Ca:  1    Cl:  9
Fe:  3    Ti:  0    Mg:  5    Na:  0    P :  0    Cu:  0
Ce:  7    Zn:  0    Ba:  7    Pb:  0
AVE DIA=        8.34 uM  MAX DIA=      17.13 uM  MIN DIA=       2.63 uM
AREA=      54.07 uM^2  PERIMETER=     63.28 uM  SHAPE FACTOR=   5.892

PART NO:   557  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      343
ELEMENT CONCENTRATIONS:
Al: 16    Si: 51    S :  2    K :  0    Ca:  9    Cl:  0
Fe:  2    Ti:  8    Mg:  2    Na:  4    P :  0    Cu:  1
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        6.15 uM  MAX DIA=      10.54 uM  MIN DIA=       3.51 uM
AREA=      34.27 uM^2  PERIMETER=     32.08 uM  SHAPE FACTOR=   2.388

PART NO:   558  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      328
ELEMENT CONCENTRATIONS:
Al: 45    Si: 25    S :  0    K : 12    Ca:  5    Cl:  0
Fe:  0    Ti:  3    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  3    Zn:  0    Ba:  0    Pb:  2
AVE DIA=        9.66 uM  MAX DIA=      21.53 uM  MIN DIA=       3.51 uM
AREA=      93.85 uM^2  PERIMETER=     58.00 uM  SHAPE FACTOR=   2.852

PART NO:   561  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      763
ELEMENT CONCENTRATIONS:
Al: 21    Si: 66    S :  0    K :  0    Ca:  0    Cl:  2
Fe:  4    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  2    Ba:  0    Pb:  0
AVE DIA=        6.15 uM  MAX DIA=       8.78 uM  MIN DIA=       3.95 uM
AREA=      32.44 uM^2  PERIMETER=     27.24 uM  SHAPE FACTOR=   1.820
```

```
PART NO:    568  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      614
ELEMENT CONCENTRATIONS:
Al: 17    Si: 64    S :  0    K :  2    Ca:  2    Cl:  0
Fe:  0    Ti:  3    Mg:  0    Na:  0    P :  0    Cu:  3
Ce:  0    Zn:  1    Ba:  0    Pb:  1
AVE DIA=       10.54 uM  MAX DIA=       21.53 uM  MIN DIA=        2.63 uM
AREA=       91.82 uM^2  PERIMETER=       57.12 uM  SHAPE FACTOR=   2.827

PART NO:    575  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1725
ELEMENT CONCENTRATIONS:
Al: 16    Si: 71    S :  3    K :  1    Ca:  1    Cl:  0
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       11.86 uM  MAX DIA=       23.29 uM  MIN DIA=        6.59 uM
AREA=      146.77 uM^2  PERIMETER=       62.40 uM  SHAPE FACTOR=   2.111

PART NO:    576  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1338
ELEMENT CONCENTRATIONS:
Al: 22    Si: 13    S :  0    K :  0    Ca: 50    Cl:  2
Fe:  0    Ti:  0    Mg:  1    Na:  0    P :  4    Cu:  0
Ce:  2    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       25.48 uM  MAX DIA=       36.03 uM  MIN DIA=       18.45 uM
AREA=      509.73 uM^2  PERIMETER=      102.83 uM  SHAPE FACTOR=   1.650

PART NO:    579  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      199
ELEMENT CONCENTRATIONS:
Al: 25    Si: 50    S : 22    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  2    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        8.34 uM  MAX DIA=       24.60 uM  MIN DIA=        2.19 uM
AREA=       69.61 uM^2  PERIMETER=       67.67 uM  SHAPE FACTOR=   5.234

PART NO:    581  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      527
ELEMENT CONCENTRATIONS:
Al: 52    Si: 15    S : 10    K :  2    Ca:  0    Cl:  0
Fe:  5    Ti:  0    Mg:  0    Na:  2    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  7    Pb:  0
AVE DIA=       14.50 uM  MAX DIA=       22.05 uM  MIN DIA=        9.66 uM
AREA=      168.20 uM^2  PERIMETER=       78.22 uM  SHAPE FACTOR=   2.894

PART NO:    583  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1127
ELEMENT CONCENTRATIONS:
Al: 50    Si: 31    S :  1    K :  1    Ca:  2    Cl:  0
Fe:  3    Ti:  1    Mg:  2    Na:  1    P :  1    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=       10.98 uM  MAX DIA=       18.89 uM  MIN DIA=        7.03 uM
AREA=      104.57 uM^2  PERIMETER=       47.02 uM  SHAPE FACTOR=   1.682
```

```
PART NO:    587  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      454
ELEMENT CONCENTRATIONS:
Al: 22    Si: 54    S :  7    K :  0    Ca:  0    Cl:  2
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  1    Zn:  2    Ba:  0    Pb:  5
AVE DIA=        8.34 uM  MAX DIA=       14.50 uM  MIN DIA=        3.51 uM
AREA=       66.52 uM^2  PERIMETER=       44.82 uM  SHAPE FACTOR=   2.402

PART NO:    590  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      995
ELEMENT CONCENTRATIONS:
Al:  5    Si:  1    S :  0    K :  0    Ca:  0    Cl:  0
Fe: 75    Ti:  0    Mg:  1    Na:  1    P :  5    Cu:  1
Ce:  4    Zn:  0    Ba:  0    Pb:  4
AVE DIA=        6.59 uM  MAX DIA=       10.98 uM  MIN DIA=        3.95 uM
AREA=       44.22 uM^2  PERIMETER=       31.20 uM  SHAPE FACTOR=   1.751

PART NO:    593  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      276
ELEMENT CONCENTRATIONS:
Al: 42    Si:  9    S :  1    K :  0    Ca: 14    Cl:  2
Fe:  0    Ti:  2    Mg:  0    Na:  7    P :  0    Cu:  0
Ce:  7    Zn:  4    Ba:  6    Pb:  0
AVE DIA=        6.15 uM  MAX DIA=       11.42 uM  MIN DIA=        0.87 uM
AREA=       41.42 uM^2  PERIMETER=       38.23 uM  SHAPE FACTOR=   2.807

PART NO:    598  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      487
ELEMENT CONCENTRATIONS:
Al: 36    Si: 36    S :  0    K :  1    Ca:  7    Cl:  1
Fe:  3    Ti:  2    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       17.57 uM  MAX DIA=       30.32 uM  MIN DIA=        8.78 uM
AREA=      234.92 uM^2  PERIMETER=       99.75 uM  SHAPE FACTOR=   3.370

PART NO:    607  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      603
ELEMENT CONCENTRATIONS:
Al: 29    Si: 51    S : 11    K :  0    Ca:  0    Cl:  4
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  1
AVE DIA=       11.86 uM  MAX DIA=       20.21 uM  MIN DIA=        4.83 uM
AREA=      139.52 uM^2  PERIMETER=       56.68 uM  SHAPE FACTOR=   1.832

PART NO:    608  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1494
ELEMENT CONCENTRATIONS:
Al: 29    Si: 56    S :  1    K :  3    Ca:  0    Cl:  3
Fe:  0    Ti:  4    Mg:  0    Na:  0    P :  1    Cu:  1
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       10.54 uM  MAX DIA=       13.62 uM  MIN DIA=        5.71 uM
AREA=       96.46 uM^2  PERIMETER=       45.26 uM  SHAPE FACTOR=   1.689
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```
PART NO:   610  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      388
ELEMENT CONCENTRATIONS:
Al: 48    Si:  6    S :  1    K : 10    Ca:  0    Cl:  0
Fe: 10    Ti:  1    Mg:  4    Na:  0    P :  6    Cu:  0
Ce:  4    Zn:  4    Ba:  0    Pb:  0
AVE DIA=       14.94 uM  MAX DIA=       21.53 uM  MIN DIA=       11.42 uM
AREA=     173.51 uM^2  PERIMETER=       65.47 uM  SHAPE FACTOR=   1.966

PART NO:   614  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      615
ELEMENT CONCENTRATIONS:
Al: 48    Si: 27    S :  0    K :  0    Ca:  2    Cl:  0
Fe:  8    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  4
Ce:  0    Zn:  0    Ba:  3    Pb:  2
AVE DIA=       12.74 uM  MAX DIA=       25.48 uM  MIN DIA=        9.22 uM
AREA=     137.21 uM^2  PERIMETER=       67.67 uM  SHAPE FACTOR=   2.655

PART NO:   622  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      828
ELEMENT CONCENTRATIONS:
Al: 51    Si: 30    S :  0    K :  2    Ca:  4    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  2    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  4    Pb:  0
AVE DIA=       22.41 uM  MAX DIA=       31.20 uM  MIN DIA=        9.66 uM
AREA=     406.90 uM^2  PERIMETER=      121.28 uM  SHAPE FACTOR=   2.876

PART NO:   627  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      639
ELEMENT CONCENTRATIONS:
Al:  5    Si: 17    S :  0    K :  1    Ca: 42    Cl:  0
Fe:  5    Ti:  5    Mg:  0    Na:  2    P : 13    Cu:  1
Ce:  0    Zn:  0    Ba:  2    Pb:  2
AVE DIA=        7.03 uM  MAX DIA=       10.98 uM  MIN DIA=        2.63 uM
AREA=      42.29 uM^2  PERIMETER=       39.55 uM  SHAPE FACTOR=   2.942

PART NO:   633  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      518
ELEMENT CONCENTRATIONS:
Al: 52    Si:  0    S :  5    K :  3    Ca: 10    Cl:  0
Fe:  2    Ti:  8    Mg:  0    Na:  3    P :  0    Cu:  0
Ce:  5    Zn:  6    Ba:  0    Pb:  0
AVE DIA=        5.27 uM  MAX DIA=        9.66 uM  MIN DIA=        1.75 uM
AREA=      32.44 uM^2  PERIMETER=       29.44 uM  SHAPE FACTOR=   2.126

PART NO:   635  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      836
ELEMENT CONCENTRATIONS:
Al: 57    Si: 21    S :  3    K :  4    Ca:  1    Cl:  3
Fe:  0    Ti:  0    Mg:  1    Na:  2    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=       10.10 uM  MAX DIA=       33.83 uM  MIN DIA=        2.63 uM
AREA=     108.14 uM^2  PERIMETER=       74.26 uM  SHAPE FACTOR=   4.058
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LABEL: 85-197-P587-200-1100-0   500X                              PAGE:  30

PART NO:    636  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      843
ELEMENT CONCENTRATIONS:
Al: 17    Si: 64    S :  4    K :  0    Ca:  0    Cl:  4
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  1    Cu:  1
Ce:  0    Zn:  0    Ba:  5    Pb:  0
AVE DIA=        5.71 uM  MAX DIA=        9.66 uM  MIN DIA=        2.63 uM
AREA=       37.65 uM^2  PERIMETER=      31.20 uM  SHAPE FACTOR=   2.056

PART NO:    648  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      451
ELEMENT CONCENTRATIONS:
Al: 52    Si:  4    S :  4    K :  0    Ca:  7    Cl:  1
Fe:  7    Ti:  0    Mg:  3    Na:  3    P :  2    Cu:  4
Ce:  1    Zn:  0    Ba:  5    Pb:  0
AVE DIA=        7.47 uM  MAX DIA=       14.06 uM  MIN DIA=        4.83 uM
AREA=       48.08 uM^2  PERIMETER=      54.93 uM  SHAPE FACTOR=   4.992

PART NO:    653  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1084
ELEMENT CONCENTRATIONS:
Al:  9    Si: 72    S :  0    K :  0    Ca:  0    Cl:  3
Fe:  4    Ti:  1    Mg:  0    Na:  1    P :  0    Cu:  1
Ce:  0    Zn:  1    Ba:  0    Pb:  2
AVE DIA=        8.78 uM  MAX DIA=       22.41 uM  MIN DIA=        2.63 uM
AREA=       95.49 uM^2  PERIMETER=      65.47 uM  SHAPE FACTOR=   3.572

PART NO:    654  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      302
ELEMENT CONCENTRATIONS:
Al:  2    Si: 34    S : 11    K :  0    Ca:  7    Cl:  0
Fe: 19    Ti: 14    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  5    Ba:  0    Pb:  4
AVE DIA=        5.71 uM  MAX DIA=       10.54 uM  MIN DIA=        3.51 uM
AREA=       34.95 uM^2  PERIMETER=      34.71 uM  SHAPE FACTOR=   2.743

PART NO:    663  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      721
ELEMENT CONCENTRATIONS:
Al: 48    Si: 17    S :  2    K :  2    Ca:  0    Cl:  0
Fe:  5    Ti:  4    Mg:  0    Na:  1    P :  2    Cu:  1
Ce:  5    Zn:  1    Ba:  4    Pb:  1
AVE DIA=       27.24 uM  MAX DIA=       45.26 uM  MIN DIA=       11.86 uM
AREA=      663.07 uM^2  PERIMETER=     130.95 uM  SHAPE FACTOR=   2.057

PART NO:    665  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1238
ELEMENT CONCENTRATIONS:
Al: 19    Si: 22    S :  3    K :  0    Ca:  2    Cl:  0
Fe:  0    Ti: 45    Mg:  0    Na:  0    P :  1    Cu:  1
Ce:  0    Zn:  1    Ba:  0    Pb:  1
AVE DIA=        5.71 uM  MAX DIA=       13.18 uM  MIN DIA=        3.07 uM
AREA=       25.49 uM^2  PERIMETER=      40.42 uM  SHAPE FACTOR=   5.101
```

```
PART NO:    668  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:     1087
ELEMENT CONCENTRATIONS:
Al: 22     Si: 70     S :  0     K :  0     Ca:  1     Cl:  0
Fe:  2     Ti:  0     Mg:  0     Na:  1     P :  0     Cu:  1
Ce:  0     Zn:  0     Ba:  0     Pb:  0
AVE DIA=         5.71 uM  MAX DIA=         8.78 uM  MIN DIA=         3.95 uM
AREA=       28.09 uM^2  PERIMETER=        22.41 uM  SHAPE FACTOR=   1.422

PART NO:    671  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:     1171
ELEMENT CONCENTRATIONS:
Al: 42     Si: 43     S :  7     K :  0     Ca:  0     Cl:  0
Fe:  1     Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  2     Zn:  1     Ba:  0     Pb:  0
AVE DIA=         5.71 uM  MAX DIA=         9.66 uM  MIN DIA=         4.83 uM
AREA=       28.77 uM^2  PERIMETER=        25.48 uM  SHAPE FACTOR=   1.796

PART NO:    672  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      875
ELEMENT CONCENTRATIONS:
Al: 23     Si: 19     S :  0     K :  2     Ca:  0     Cl:  0
Fe:  3     Ti: 44     Mg:  0     Na:  0     P :  0     Cu:  1
Ce:  2     Zn:  1     Ba:  0     Pb:  0
AVE DIA=         8.78 uM  MAX DIA=        13.62 uM  MIN DIA=         6.15 uM
AREA=       67.49 uM^2  PERIMETER=        45.26 uM  SHAPE FACTOR=   2.415

PART NO:    676  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      586
ELEMENT CONCENTRATIONS:
Al: 20     Si: 48     S :  5     K :  1     Ca:  3     Cl:  0
Fe:  5     Ti:  2     Mg:  0     Na:  0     P :  3     Cu:  3
Ce:  0     Zn:  1     Ba:  5     Pb:  0
AVE DIA=         7.47 uM  MAX DIA=        17.57 uM  MIN DIA=         3.07 uM
AREA=       51.94 uM^2  PERIMETER=        40.86 uM  SHAPE FACTOR=   2.558

PART NO:    678  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      697
ELEMENT CONCENTRATIONS:
Al: 55     Si: 24     S :  4     K :  0     Ca:  0     Cl:  3
Fe:  0     Ti:  1     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  5     Zn:  1     Ba:  0     Pb:  2
AVE DIA=        13.18 uM  MAX DIA=        30.32 uM  MIN DIA=         6.15 uM
AREA=      147.54 uM^2  PERIMETER=        72.50 uM  SHAPE FACTOR=   2.835

PART NO:    682  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      233
ELEMENT CONCENTRATIONS:
Al:  0     Si: 60     S :  3     K : 10     Ca:  0     Cl:  0
Fe: 12     Ti:  3     Mg:  0     Na:  0     P :  0     Cu:  3
Ce:  1     Zn:  0     Ba:  0     Pb:  3
AVE DIA=         5.27 uM  MAX DIA=         7.47 uM  MIN DIA=         3.51 uM
AREA=       28.87 uM^2  PERIMETER=        27.68 uM  SHAPE FACTOR=   2.112
```

```
PART NO:    684  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       706
ELEMENT CONCENTRATIONS:
Al: 22     Si: 40     S :  2     K :  0     Ca:  0     Cl:  0
Fe: 29     Ti:  0     Mg:  0     Na:  0     P :  4     Cu:  0
Ce:  0     Zn:  0     Ba:  0     Pb:  0
AVE DIA=        10.10 uM  MAX DIA=        16.69 uM  MIN DIA=         5.71 uM
AREA=       82.36 uM^2  PERIMETER=        60.64 uM  SHAPE FACTOR=   3.552

PART NO:    691  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       381
ELEMENT CONCENTRATIONS:
Al: 34     Si: 31     S :  0     K :  2     Ca: 13     Cl:  0
Fe: 12     Ti:  0     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  2     Ba:  0     Pb:  2
AVE DIA=        12.74 uM  MAX DIA=        24.60 uM  MIN DIA=         6.59 uM
AREA=      139.72 uM^2  PERIMETER=        87.89 uM  SHAPE FACTOR=   4.399

PART NO:    694  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       451
ELEMENT CONCENTRATIONS:
Al: 41     Si: 22     S :  1     K :  0     Ca:  2     Cl:  9
Fe:  8     Ti:  8     Mg:  0     Na:  0     P :  0     Cu:  0
Ce:  5     Zn:  0     Ba:  0     Pb:  0
AVE DIA=        11.42 uM  MAX DIA=        26.80 uM  MIN DIA=         4.83 uM
AREA=      108.62 uM^2  PERIMETER=        75.14 uM  SHAPE FACTOR=   4.136

PART NO:    697  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       523
ELEMENT CONCENTRATIONS:
Al: 17     Si: 56     S :  5     K :  0     Ca:  5     Cl:  0
Fe:  0     Ti:  1     Mg:  4     Na:  0     P :  0     Cu:  2
Ce:  0     Zn:  4     Ba:  0     Pb:  0
AVE DIA=         6.15 uM  MAX DIA=         7.91 uM  MIN DIA=         3.51 uM
AREA=       31.57 uM^2  PERIMETER=        25.92 uM  SHAPE FACTOR=   1.694

PART NO:    703  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       649
ELEMENT CONCENTRATIONS:
Al: 44     Si: 28     S :  6     K :  3     Ca:  1     Cl:  3
Fe:  2     Ti:  7     Mg:  0     Na:  0     P :  0     Cu:  1
Ce:  0     Zn:  0     Ba:  0     Pb:  1
AVE DIA=        12.30 uM  MAX DIA=        19.33 uM  MIN DIA=         4.83 uM
AREA=      125.91 uM^2  PERIMETER=        66.35 uM  SHAPE FACTOR=   2.782

PART NO:    705  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       407
ELEMENT CONCENTRATIONS:
Al: 54     Si:  3     S :  2     K :  3     Ca:  0     Cl:  0
Fe:  3     Ti:  6     Mg:  0     Na:  0     P :  2     Cu:  8
Ce:  9     Zn:  0     Ba:  3     Pb:  0
AVE DIA=        25.92 uM  MAX DIA=        45.70 uM  MIN DIA=        18.45 uM
AREA=      550.87 uM^2  PERIMETER=       118.21 uM  SHAPE FACTOR=   2.018
```

```
PART NO:   710  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      349
ELEMENT CONCENTRATIONS:
Al: 42    Si: 23    S :  0    K :  5    Ca:  0    Cl:  4
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  4    Zn:  8    Ba:  0    Pb:  6
AVE DIA=       17.13 uM  MAX DIA=      37.79 uM  MIN DIA=       5.71 uM
AREA=     300.30 uM^2  PERIMETER=      97.11 uM  SHAPE FACTOR=   2.499

PART NO:   716  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      363
ELEMENT CONCENTRATIONS:
Al: 52    Si:  4    S :  9    K : 10    Ca:  0    Cl:  2
Fe:  0    Ti:  3    Mg:  0    Na:  0    P :  1    Cu:  1
Ce:  0    Zn:  6    Ba:  0    Pb:  6
AVE DIA=       21.09 uM  MAX DIA=      37.79 uM  MIN DIA=      11.86 uM
AREA=     328.01 uM^2  PERIMETER=     141.50 uM  SHAPE FACTOR=   4.857

PART NO:   720  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      430
ELEMENT CONCENTRATIONS:
Al: 51    Si: 27    S :  1    K :  0    Ca:  3    Cl:  0
Fe:  0    Ti:  6    Mg:  0    Na:  2    P :  3    Cu:  3
Ce:  0    Zn:  0    Ba:  1    Pb:  0
AVE DIA=       17.13 uM  MAX DIA=      39.99 uM  MIN DIA=       8.34 uM
AREA=     235.41 uM^2  PERIMETER=     121.72 uM  SHAPE FACTOR=   5.008

PART NO:   721  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      844
ELEMENT CONCENTRATIONS:
Al: 51    Si: 29    S :  0    K :  6    Ca:  0    Cl:  0
Fe:  2    Ti:  5    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  1    Zn:  0    Ba:  1    Pb:  1
AVE DIA=       17.57 uM  MAX DIA=      41.30 uM  MIN DIA=       7.47 uM
AREA=     277.12 uM^2  PERIMETER=     122.16 uM  SHAPE FACTOR=   4.285

PART NO:   725  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      717
ELEMENT CONCENTRATIONS:
Al: 34    Si: 42    S :  2    K :  0    Ca:  3    Cl:  3
Fe:  2    Ti:  8    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        8.78 uM  MAX DIA=      12.74 uM  MIN DIA=       5.71 uM
AREA=      72.99 uM^2  PERIMETER=      43.50 uM  SHAPE FACTOR=   2.063

PART NO:   729  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      830
ELEMENT CONCENTRATIONS:
Al: 55    Si: 28    S :  0    K :  0    Ca:  0    Cl:  5
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  0    Ba:  2    Pb:  2
AVE DIA=        7.47 uM  MAX DIA=      21.53 uM  MIN DIA=       3.51 uM
AREA=      56.87 uM^2  PERIMETER=      49.21 uM  SHAPE FACTOR=   3.389
```

```
PART NO:    730  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       431
ELEMENT CONCENTRATIONS:
Al: 39     Si:  8     S : 11     K :  4     Ca:  1     Cl:  1
Fe:  4     Ti:  9     Mg:  0     Na:  2     P :  3     Cu:  1
Ce:  7     Zn:  0     Ba:  3     Pb:  0
AVE DIA=          7.03 uM  MAX DIA=        20.21 uM  MIN DIA=         2.19 uM
AREA=        45.47 uM^2  PERIMETER=        47.90 uM  SHAPE FACTOR=   4.014

PART NO:    732  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       761
ELEMENT CONCENTRATIONS:
Al: 54     Si: 22     S :  0     K :  4     Ca:  0     Cl:  0
Fe:  2     Ti:  0     Mg:  0     Na:  0     P :  7     Cu:  0
Ce:  2     Zn:  0     Ba:  3     Pb:  2
AVE DIA=         19.77 uM  MAX DIA=        43.06 uM  MIN DIA=        10.54 uM
AREA=       312.17 uM^2  PERIMETER=       126.12 uM  SHAPE FACTOR=   4.054

PART NO:    734  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       746
ELEMENT CONCENTRATIONS:
Al: 56     Si: 31     S :  0     K :  0     Ca:  0     Cl:  0
Fe:  4     Ti:  0     Mg:  0     Na:  1     P :  0     Cu:  2
Ce:  2     Zn:  0     Ba:  0     Pb:  0
AVE DIA=          7.47 uM  MAX DIA=        10.98 uM  MIN DIA=         6.15 uM
AREA=        46.73 uM^2  PERIMETER=        29.88 uM  SHAPE FACTOR=   1.520

PART NO:    737  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       542
ELEMENT CONCENTRATIONS:
Al: 47     Si: 24     S :  7     K :  0     Ca:  7     Cl:  0
Fe:  0     Ti:  0     Mg:  0     Na:  0     P :  6     Cu:  0
Ce:  0     Zn:  0     Ba:  5     Pb:  0
AVE DIA=          5.71 uM  MAX DIA=        10.10 uM  MIN DIA=         3.51 uM
AREA=        30.22 uM^2  PERIMETER=        33.83 uM  SHAPE FACTOR=   3.014

PART NO:    746  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       832
ELEMENT CONCENTRATIONS:
Al:  5     Si: 79     S :  3     K :  2     Ca:  0     Cl:  0
Fe:  0     Ti:  0     Mg:  2     Na:  1     P :  2     Cu:  1
Ce:  0     Zn:  0     Ba:  0     Pb:  1
AVE DIA=         10.10 uM  MAX DIA=        15.38 uM  MIN DIA=         5.27 uM
AREA=        98.58 uM^2  PERIMETER=        64.59 uM  SHAPE FACTOR=   3.368

PART NO:    749  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       329
ELEMENT CONCENTRATIONS:
Al: 47     Si: 27     S :  6     K :  0     Ca:  0     Cl:  6
Fe:  0     Ti:  0     Mg:  2     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  2     Ba:  0     Pb:  6
AVE DIA=         14.94 uM  MAX DIA=        21.53 uM  MIN DIA=        10.10 uM
AREA=       183.55 uM^2  PERIMETER=        55.81 uM  SHAPE FACTOR=   1.350
```

```
PART NO:   750  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      590
ELEMENT CONCENTRATIONS:
Al: 30    Si: 28    S :  4    K :  0    Ca:  5    Cl:  8
Fe:  5    Ti:  4    Mg:  0    Na:  0    P :  4    Cu:  1
Ce:  0    Zn:  0    Ba:  2    Pb:  3
AVE DIA=       16.69 uM  MAX DIA=       29.44 uM  MIN DIA=        5.27 uM
AREA=     201.13 uM^2  PERIMETER=      119.53 uM  SHAPE FACTOR=   5.652

PART NO:   751  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      499
ELEMENT CONCENTRATIONS:
Al: 29    Si: 46    S :  0    K :  1    Ca:  0    Cl:  0
Fe:  8    Ti:  2    Mg:  0    Na:  4    P :  2    Cu:  3
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        7.03 uM  MAX DIA=       10.98 uM  MIN DIA=        3.51 uM
AREA=      52.62 uM^2  PERIMETER=       37.35 uM  SHAPE FACTOR=   2.109

PART NO:   753  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1420
ELEMENT CONCENTRATIONS:
Al: 51    Si: 28    S :  4    K :  4    Ca:  1    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  1    P :  0    Cu:  2
Ce:  3    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       11.42 uM  MAX DIA=       27.24 uM  MIN DIA=        4.83 uM
AREA=     129.87 uM^2  PERIMETER=       65.03 uM  SHAPE FACTOR=   2.591

PART NO:   758  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      480
ELEMENT CONCENTRATIONS:
Al: 49    Si: 13    S :  3    K : 10    Ca:  0    Cl:  3
Fe:  0    Ti:  0    Mg:  0    Na:  1    P :  8    Cu:  2
Ce:  0    Zn:  2    Ba:  4    Pb:  0
AVE DIA=       18.01 uM  MAX DIA=       27.24 uM  MIN DIA=        9.22 uM
AREA=     262.83 uM^2  PERIMETER=      100.63 uM  SHAPE FACTOR=   3.065

PART NO:   764  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1125
ELEMENT CONCENTRATIONS:
Al: 50    Si: 31    S :  1    K :  2    Ca:  0    Cl:  3
Fe:  5    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       33.83 uM  MAX DIA=       54.93 uM  MIN DIA=       20.65 uM
AREA=     904.76 uM^2  PERIMETER=      188.08 uM  SHAPE FACTOR=   3.111

PART NO:   766  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      390
ELEMENT CONCENTRATIONS:
Al: 20    Si: 57    S :  0    K :  1    Ca:  3    Cl:  0
Fe:  1    Ti:  0    Mg:  0    Na:  2    P :  0    Cu:  1
Ce:  5    Zn:  0    Ba:  4    Pb:  1
AVE DIA=       12.74 uM  MAX DIA=       21.53 uM  MIN DIA=        6.59 uM
AREA=     143.00 uM^2  PERIMETER=       80.85 uM  SHAPE FACTOR=   3.637
```

```
PART NO:   769  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      722
ELEMENT CONCENTRATIONS:
Al: 57    Si: 15    S :  5    K :  2    Ca:  0    Cl:  2
Fe:  2    Ti:  3    Mg:  0    Na:  0    P :  2    Cu:  0
Ce:  0    Zn:  3    Ba:  1    Pb:  2
AVE DIA=      23.29 uM  MAX DIA=      39.11 uM  MIN DIA=       16.69 uM
AREA=       451.60 uM^2  PERIMETER=     116.01 uM  SHAPE FACTOR=   2.371

PART NO:   778  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      419
ELEMENT CONCENTRATIONS:
Al: 50    Si: 26    S :  2    K :  0    Ca:  1    Cl:  0
Fe:  4    Ti:  1    Mg:  4    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  3    Ba:  0    Pb:  3
AVE DIA=       7.47 uM  MAX DIA=      15.38 uM  MIN DIA=        2.63 uM
AREA=        59.86 uM^2  PERIMETER=      40.42 uM  SHAPE FACTOR=   2.172

PART NO:   779  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      632
ELEMENT CONCENTRATIONS:
Al: 22    Si: 54    S :  0    K :  3    Ca:  5    Cl:  0
Fe:  4    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  3    Pb:  4
AVE DIA=       5.27 uM  MAX DIA=       9.66 uM  MIN DIA=        2.63 uM
AREA=        31.47 uM^2  PERIMETER=      28.12 uM  SHAPE FACTOR=   1.999

PART NO:   787  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      373
ELEMENT CONCENTRATIONS:
Al: 42    Si: 30    S :  0    K :  6    Ca:  0    Cl:  0
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  5    Zn:  3    Ba:  7    Pb:  1
AVE DIA=       7.47 uM  MAX DIA=      17.57 uM  MIN DIA=        4.83 uM
AREA=        53.59 uM^2  PERIMETER=      46.58 uM  SHAPE FACTOR=   3.221

PART NO:   788  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      324
ELEMENT CONCENTRATIONS:
Al:  9    Si: 42    S : 13    K :  0    Ca:  8    Cl:  9
Fe:  0    Ti:  0    Mg:  2    Na:  0    P :  2    Cu:  7
Ce:  0    Zn:  0    Ba:  3    Pb:  0
AVE DIA=       7.47 uM  MAX DIA=      16.69 uM  MIN DIA=        2.63 uM
AREA=        54.94 uM^2  PERIMETER=      47.46 uM  SHAPE FACTOR=   3.262

PART NO:   791  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      429
ELEMENT CONCENTRATIONS:
Al: 60    Si: 22    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  2    Ti:  1    Mg:  0    Na:  1    P :  4    Cu:  0
Ce:  0    Zn:  2    Ba:  3    Pb:  0
AVE DIA=       7.47 uM  MAX DIA=      15.38 uM  MIN DIA=        5.71 uM
AREA=        56.00 uM^2  PERIMETER=      45.26 uM  SHAPE FACTOR=   2.910
```

```
PART NO:   793  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     312
ELEMENT CONCENTRATIONS:
Al: 34    Si: 13    S :  0    K :  0    Ca: 12    Cl:  2
Fe:  5    Ti:  0    Mg:  3    Na:  0    P :  8    Cu:  2
Ce:  7    Zn:  0    Ba:  6    Pb:  2
AVE DIA=      13.62 uM  MAX DIA=      47.90 uM  MIN DIA=       2.19 uM
AREA=     189.73 uM^2  PERIMETER=     119.09 uM  SHAPE FACTOR=   5.947

PART NO:   799  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     671
ELEMENT CONCENTRATIONS:
Al: 44    Si: 42    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  1    Ti:  6    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  1    Zn:  0    Ba:  1    Pb:  1
AVE DIA=       6.15 uM  MAX DIA=      19.33 uM  MIN DIA=       1.75 uM
AREA=      53.49 uM^2  PERIMETER=      50.97 uM  SHAPE FACTOR=   3.865

PART NO:   806  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     979
ELEMENT CONCENTRATIONS:
Al: 69    Si:  1    S :  2    K :  2    Ca:  3    Cl:  0
Fe:  5    Ti:  3    Mg:  2    Na:  2    P :  2    Cu:  2
Ce:  2    Zn:  0    Ba:  0    Pb:  0
AVE DIA=      22.41 uM  MAX DIA=      31.20 uM  MIN DIA=      10.98 uM
AREA=     438.66 uM^2  PERIMETER=      93.60 uM  SHAPE FACTOR=   1.589

PART NO:   814  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     611
ELEMENT CONCENTRATIONS:
Al: 31    Si: 51    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  3    Ti:  8    Mg:  0    Na:  0    P :  2    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=      10.10 uM  MAX DIA=      26.36 uM  MIN DIA=       4.83 uM
AREA=      83.42 uM^2  PERIMETER=      65.47 uM  SHAPE FACTOR=   4.089

PART NO:   817  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    2114
ELEMENT CONCENTRATIONS:
Al: 51    Si: 29    S :  0    K :  0    Ca:  5    Cl:  0
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  5    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=      22.85 uM  MAX DIA=      34.27 uM  MIN DIA=      13.62 uM
AREA=     438.86 uM^2  PERIMETER=     102.83 uM  SHAPE FACTOR=   1.917

PART NO:   818  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     920
ELEMENT CONCENTRATIONS:
Al: 65    Si:  3    S :  3    K :  3    Ca:  2    Cl:  2
Fe:  1    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  1
Ce:  6    Zn:  1    Ba:  0    Pb:  3
AVE DIA=      22.85 uM  MAX DIA=      47.46 uM  MIN DIA=       8.78 uM
AREA=     403.03 uM^2  PERIMETER=     157.76 uM  SHAPE FACTOR=   4.913
```

```
PART NO:    819  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       384
ELEMENT CONCENTRATIONS:
Al: 52     Si: 17     S :  6     K :  4     Ca:  0     Cl:  0
Fe:  5     Ti:  0     Mg:  0     Na:  0     P :  1     Cu:  0
Ce:  0     Zn:  2     Ba:  7     Pb:  0
AVE DIA=        21.09 uM  MAX DIA=        33.83 uM  MIN DIA=        14.50 uM
AREA=       349.93 uM^2  PERIMETER=       101.07 uM  SHAPE FACTOR=    2.322

PART NO:    824  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      1288
ELEMENT CONCENTRATIONS:
Al: 14     Si: 73     S :  3     K :  1     Ca:  0     Cl:  0
Fe:  0     Ti:  0     Mg:  2     Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  0     Ba:  1     Pb:  0
AVE DIA=        14.50 uM  MAX DIA=        19.33 uM  MIN DIA=        12.30 uM
AREA=       165.98 uM^2  PERIMETER=        63.28 uM  SHAPE FACTOR=    1.919

PART NO:    825  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       469
ELEMENT CONCENTRATIONS:
Al: 43     Si:  9     S :  7     K :  0     Ca:  0     Cl: 10
Fe:  1     Ti:  0     Mg:  0     Na:  2     P : 13     Cu:  1
Ce:  0     Zn:  0     Ba:  8     Pb:  0
AVE DIA=         8.78 uM  MAX DIA=        18.45 uM  MIN DIA=         1.75 uM
AREA=        86.90 uM^2  PERIMETER=        65.47 uM  SHAPE FACTOR=    3.925

PART NO:    831  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       550
ELEMENT CONCENTRATIONS:
Al: 50     Si: 10     S :  2     K :  0     Ca:  1     Cl:  8
Fe:  8     Ti:  0     Mg:  0     Na:  1     P :  5     Cu:  2
Ce:  0     Zn:  2     Ba:  0     Pb:  6
AVE DIA=        20.21 uM  MAX DIA=        42.18 uM  MIN DIA=         7.47 uM
AREA=       341.24 uM^2  PERIMETER=       135.79 uM  SHAPE FACTOR=    4.299

PART NO:    833  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       394
ELEMENT CONCENTRATIONS:
Al: 44     Si: 24     S :  5     K :  0     Ca:  2     Cl:  0
Fe:  2     Ti:  0     Mg:  3     Na:  0     P :  2     Cu:  0
Ce:  3     Zn:  0     Ba:  7     Pb:  3
AVE DIA=         9.22 uM  MAX DIA=        16.69 uM  MIN DIA=         4.83 uM
AREA=        71.93 uM^2  PERIMETER=        61.96 uM  SHAPE FACTOR=    4.246

PART NO:    837  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:       553
ELEMENT CONCENTRATIONS:
Al: 49     Si: 33     S :  0     K :  2     Ca:  0     Cl:  1
Fe:  0     Ti:  3     Mg:  0     Na:  0     P :  3     Cu:  0
Ce:  0     Zn:  0     Ba:  4     Pb:  0
AVE DIA=        11.86 uM  MAX DIA=        20.21 uM  MIN DIA=         5.71 uM
AREA=       114.71 uM^2  PERIMETER=        63.28 uM  SHAPE FACTOR=    2.777
```

```
PART NO:   838  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      437
ELEMENT CONCENTRATIONS:
Al: 42    Si: 23    S :  4    K :  5    Ca:  0    Cl:  0
Fe:  0    Ti: 11    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  2    Zn:  1    Ba:  7    Pb:  1
AVE DIA=        6.15 uM  MAX DIA=       12.74 uM  MIN DIA=        1.75 uM
AREA=      45.67 uM^2  PERIMETER=       35.59 uM  SHAPE FACTOR=   2.207

PART NO:   842  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      590
ELEMENT CONCENTRATIONS:
Al: 54    Si: 27    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  1    Mg:  4    Na:  0    P :  0    Cu:  5
Ce:  2    Zn:  1    Ba:  1    Pb:  1
AVE DIA=       32.95 uM  MAX DIA=       47.02 uM  MIN DIA=        7.47 uM
AREA=     928.51 uM^2  PERIMETER=      202.14 uM  SHAPE FACTOR=   3.501

PART NO:   852  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1206
ELEMENT CONCENTRATIONS:
Al: 18    Si: 65    S :  2    K :  3    Ca:  0    Cl:  0
Fe:  0    Ti:  1    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  2    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       14.06 uM  MAX DIA=       26.36 uM  MIN DIA=        7.91 uM
AREA=     146.19 uM^2  PERIMETER=       81.29 uM  SHAPE FACTOR=   3.597

PART NO:   858  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      535
ELEMENT CONCENTRATIONS:
Al: 48    Si: 21    S :  0    K :  0    Ca:  3    Cl:  0
Fe:  3    Ti:  0    Mg:  6    Na:  2    P :  8    Cu:  0
Ce:  0    Zn:  0    Ba:  4    Pb:  0
AVE DIA=       10.54 uM  MAX DIA=       27.24 uM  MIN DIA=        3.51 uM
AREA=     184.42 uM^2  PERIMETER=       75.58 uM  SHAPE FACTOR=   2.464

PART NO:   860  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      631
ELEMENT CONCENTRATIONS:
Al: 50    Si: 32    S :  0    K :  2    Ca:  3    Cl:  0
Fe:  5    Ti:  0    Mg:  0    Na:  2    P :  0    Cu:  0
Ce:  1    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       29.00 uM  MAX DIA=       72.50 uM  MIN DIA=        7.91 uM
AREA=    1043.61 uM^2  PERIMETER=      188.96 uM  SHAPE FACTOR=   2.722

PART NO:   862  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      573
ELEMENT CONCENTRATIONS:
Al: 53    Si: 25    S :  3    K :  0    Ca:  6    Cl:  0
Fe:  2    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  4    Pb:  2
AVE DIA=       12.74 uM  MAX DIA=       29.44 uM  MIN DIA=        4.83 uM
AREA=     119.83 uM^2  PERIMETER=       86.57 uM  SHAPE FACTOR=   4.976
```

```
PART NO:   865  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      707
ELEMENT CONCENTRATIONS:
Al: 51    Si: 41    S :  0    K :  0    Ca:  5    Cl:  1
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       10.10 uM  MAX DIA=       12.74 uM  MIN DIA=        8.34 uM
AREA=       80.24 uM^2  PERIMETER=       37.35 uM  SHAPE FACTOR=   1.383

PART NO:   868  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1117
ELEMENT CONCENTRATIONS:
Al: 49    Si: 27    S :  5    K :  0    Ca:  0    Cl:  1
Fe:  3    Ti:  2    Mg:  1    Na:  0    P :  4    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=        6.59 uM  MAX DIA=       11.42 uM  MIN DIA=        3.51 uM
AREA=       36.98 uM^2  PERIMETER=       29.88 uM  SHAPE FACTOR=   1.921

PART NO:   872  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      530
ELEMENT CONCENTRATIONS:
Al: 47    Si: 34    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  1    Ti:  0    Mg:  9    Na:  0    P :  0    Cu:  3
Ce:  0    Zn:  0    Ba:  0    Pb:  2
AVE DIA=       17.57 uM  MAX DIA=       66.79 uM  MIN DIA=        7.03 uM
AREA=      256.17 uM^2  PERIMETER=      146.33 uM  SHAPE FACTOR=   6.651

PART NO:   874  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1328
ELEMENT CONCENTRATIONS:
Al: 21    Si: 65    S :  2    K :  3    Ca:  2    Cl:  0
Fe:  0    Ti:  0    Mg:  2    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       13.62 uM  MAX DIA=       28.12 uM  MIN DIA=        7.47 uM
AREA=      167.04 uM^2  PERIMETER=       73.38 uM  SHAPE FACTOR=   2.565

PART NO:   875  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      353
ELEMENT CONCENTRATIONS:
Al: 57    Si: 14    S :  5    K :  2    Ca:  0    Cl:  0
Fe:  7    Ti:  3    Mg:  3    Na:  1    P :  0    Cu:  3
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        8.78 uM  MAX DIA=       12.74 uM  MIN DIA=        6.59 uM
AREA=       66.91 uM^2  PERIMETER=       39.55 uM  SHAPE FACTOR=   1.860

PART NO:   876  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      378
ELEMENT CONCENTRATIONS:
Al: 36    Si: 13    S :  5    K :  3    Ca:  0    Cl:  0
Fe: 15    Ti:  0    Mg:  0    Na:  0    P :  1    Cu:  7
Ce:  0    Zn:  1    Ba: 10    Pb:  6
AVE DIA=       16.25 uM  MAX DIA=       23.29 uM  MIN DIA=        7.03 uM
AREA=      230.19 uM^2  PERIMETER=       78.22 uM  SHAPE FACTOR=   2.114
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LABEL: 85-197-P587-200-1100-0   500X                                  PAGE:  41

PART NO:    881  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      744
ELEMENT CONCENTRATIONS:
Al: 52    Si: 30    S :  0    K :  2    Ca:  0    Cl:  6
Fe:  1    Ti:  0    Mg:  0    Na:  0    P :  3    Cu:  1
Ce:  0    Zn:  0    Ba:  1    Pb:  0
AVE DIA=        8.34 uM  MAX DIA=       11.86 uM  MIN DIA=        6.59 uM
AREA=      62.37 uM^2  PERIMETER=       37.35 uM  SHAPE FACTOR=   1.779

PART NO:    887  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      645
ELEMENT CONCENTRATIONS:
Al: 17    Si: 59    S :  8    K :  0    Ca:  0    Cl:  2
Fe:  0    Ti:  1    Mg:  0    Na:  0    P :  3    Cu:  0
Ce:  2    Zn:  2    Ba:  1    Pb:  0
AVE DIA=        7.47 uM  MAX DIA=       13.62 uM  MIN DIA=        3.51 uM
AREA=      57.35 uM^2  PERIMETER=       43.06 uM  SHAPE FACTOR=   2.572

PART NO:    889  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      625
ELEMENT CONCENTRATIONS:
Al: 37    Si: 39    S :  9    K :  0    Ca:  0    Cl:  0
Fe:  2    Ti:  3    Mg:  0    Na:  0    P :  1    Cu:  0
Ce:  3    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       22.41 uM  MAX DIA=       32.51 uM  MIN DIA=        9.22 uM
AREA=     366.63 uM^2  PERIMETER=      119.97 uM  SHAPE FACTOR=   3.123

PART NO:    893  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      898
ELEMENT CONCENTRATIONS:
Al: 16    Si: 70    S :  1    K :  0    Ca:  0    Cl:  3
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  2    Ba:  3    Pb:  0
AVE DIA=        8.78 uM  MAX DIA=       12.30 uM  MIN DIA=        6.59 uM
AREA=      67.88 uM^2  PERIMETER=       39.55 uM  SHAPE FACTOR=   1.833

PART NO:    917  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      492
ELEMENT CONCENTRATIONS:
Al: 49    Si: 28    S :  0    K :  0    Ca:  5    Cl:  5
Fe:  0    Ti:  0    Mg:  0    Na:  0    P :  1    Cu:  4
Ce:  0    Zn:  0    Ba:  1    Pb:  2
AVE DIA=        5.27 uM  MAX DIA=        6.59 uM  MIN DIA=        3.51 uM
AREA=      24.04 uM^2  PERIMETER=       21.97 uM  SHAPE FACTOR=   1.597

PART NO:    919  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1202
ELEMENT CONCENTRATIONS:
Al:  4    Si:  3    S :  0    K :  0    Ca:  0    Cl:  1
Fe: 78    Ti:  0    Mg:  1    Na:  0    P :  0    Cu:  5
Ce:  0    Zn:  1    Ba:  1    Pb:  1
AVE DIA=       18.01 uM  MAX DIA=       23.29 uM  MIN DIA=       12.74 uM
AREA=     260.22 uM^2  PERIMETER=       67.67 uM  SHAPE FACTOR=   1.400
```

```
PART NO:    921  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      611
ELEMENT CONCENTRATIONS:
Al: 49     Si: 31    S :  0    K :  0    Ca:  0    Cl:  1
Fe:  1     Ti:  2    Mg:  3    Na:  0    P :  0    Cu:  0
Ce:  3     Zn:  0    Ba:  3    Pb:  2
AVE DIA=       21.97 uM  MAX DIA=       40.86 uM  MIN DIA=       9.66 uM
AREA=      475.84 uM^2  PERIMETER=     115.13 uM  SHAPE FACTOR=   2.216

PART NO:    923  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      619
ELEMENT CONCENTRATIONS:
Al: 46     Si: 37    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  4     Ti:  0    Mg:  4    Na:  0    P :  1    Cu:  1
Ce:  3     Zn:  0    Ba:  0    Pb:  0
AVE DIA=        7.47 uM  MAX DIA=       10.10 uM  MIN DIA=       4.83 uM
AREA=       49.24 uM^2  PERIMETER=      34.71 uM  SHAPE FACTOR=   1.947

PART NO:    927  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      274
ELEMENT CONCENTRATIONS:
Al: 47     Si: 24    S :  0    K :  0    Ca:  0    Cl:  0
Fe:  4     Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  8     Zn:  0    Ba: 14    Pb:  0
AVE DIA=       18.89 uM  MAX DIA=       28.56 uM  MIN DIA=       6.59 uM
AREA=      300.97 uM^2  PERIMETER=     110.30 uM  SHAPE FACTOR=   3.216

PART NO:    929  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      486
ELEMENT CONCENTRATIONS:
Al: 30     Si: 39    S :  0    K :  0    Ca:  4    Cl:  4
Fe:  3     Ti:  6    Mg:  0    Na:  2    P :  0    Cu:  0
Ce:  3     Zn:  2    Ba:  2    Pb:  0
AVE DIA=       16.69 uM  MAX DIA=       47.90 uM  MIN DIA=       3.95 uM
AREA=      351.66 uM^2  PERIMETER=     110.30 uM  SHAPE FACTOR=   2.752

PART NO:    931  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      363
ELEMENT CONCENTRATIONS:
Al: 45     Si:  6    S : 14    K :  1    Ca:  0    Cl:  6
Fe:  0     Ti: 12    Mg:  2    Na:  0    P :  6    Cu:  1
Ce:  0     Zn:  0    Ba:  2    Pb:  0
AVE DIA=       21.09 uM  MAX DIA=       34.27 uM  MIN DIA=      10.98 uM
AREA=      342.11 uM^2  PERIMETER=     106.34 uM  SHAPE FACTOR=   2.630

PART NO:    938  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      798
ELEMENT CONCENTRATIONS:
Al: 20     Si: 70    S :  0    K :  0    Ca:  2    Cl:  0
Fe:  0     Ti:  0    Mg:  0    Na:  0    P :  0    Cu:  0
Ce:  3     Zn:  1    Ba:  0    Pb:  0
AVE DIA=        8.34 uM  MAX DIA=       13.62 uM  MIN DIA=       3.51 uM
AREA=       58.61 uM^2  PERIMETER=      64.59 uM  SHAPE FACTOR=   5.665
```

```
PART NO:    945  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       474
ELEMENT CONCENTRATIONS:
Al: 31     Si: 33     S : 12    K :  0     Ca:  3     Cl:  0
Fe:  0     Ti:  4     Mg:  0    Na:  0     P :  0     Cu:  2
Ce:  1     Zn:  0     Ba:  4    Pb:  4
AVE DIA=        14.50 uM  MAX DIA=        44.82 uM  MIN DIA=        4.83 uM
AREA=      288.51 uM^2  PERIMETER=      105.46 uM  SHAPE FACTOR=   3.067

PART NO:    948  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       528
ELEMENT CONCENTRATIONS:
Al: 58     Si: 22     S :  0    K :  0     Ca:  0     Cl:  0
Fe:  5     Ti:  0     Mg:  4    Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  2     Ba:  3    Pb:  3
AVE DIA=        40.42 uM  MAX DIA=        51.85 uM  MIN DIA=       23.29 uM
AREA=     1234.03 uM^2  PERIMETER=      187.20 uM  SHAPE FACTOR=   2.259

PART NO:    950  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       858
ELEMENT CONCENTRATIONS:
Al: 48     Si: 24     S :  0    K :  6     Ca:  2     Cl:  3
Fe:  3     Ti:  0     Mg:  0    Na:  0     P :  3     Cu:  1
Ce:  1     Zn:  1     Ba:  0    Pb:  0
AVE DIA=         7.03 uM  MAX DIA=         8.34 uM  MIN DIA=        4.83 uM
AREA=       43.25 uM^2  PERIMETER=       28.56 uM  SHAPE FACTOR=   1.500

PART NO:    954  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       361
ELEMENT CONCENTRATIONS:
Al: 60     Si: 21     S :  5    K :  1     Ca:  0     Cl:  3
Fe:  0     Ti:  0     Mg:  0    Na:  0     P :  0     Cu:  0
Ce:  0     Zn:  2     Ba:  1    Pb:  4
AVE DIA=        19.33 uM  MAX DIA=        39.11 uM  MIN DIA=        9.66 uM
AREA=      311.88 uM^2  PERIMETER=      124.80 uM  SHAPE FACTOR=   3.973

PART NO:    960  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       558
ELEMENT CONCENTRATIONS:
Al: 34     Si: 45     S :  0    K :  0     Ca:  4     Cl:  1
Fe:  4     Ti:  3     Mg:  1    Na:  0     P :  3     Cu:  0
Ce:  0     Zn:  0     Ba:  0    Pb:  0
AVE DIA=        10.10 uM  MAX DIA=        12.74 uM  MIN DIA=        7.47 uM
AREA=       85.35 uM^2  PERIMETER=       41.30 uM  SHAPE FACTOR=   1.590

PART NO:    967  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:       321
ELEMENT CONCENTRATIONS:
Al: 27     Si: 50     S :  4    K :  1     Ca:  0     Cl:  0
Fe:  1     Ti:  7     Mg:  0    Na:  0     P :  0     Cu:  6
Ce:  0     Zn:  0     Ba:  0    Pb:  0
AVE DIA=         7.47 uM  MAX DIA=        13.62 uM  MIN DIA=        0.87 uM
AREA=       67.20 uM^2  PERIMETER=       48.33 uM  SHAPE FACTOR=   2.766
```

```
PART NO:   985  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      623
ELEMENT CONCENTRATIONS:
Al: 39    Si: 23    S :  0    K :  0    Ca:  3    Cl:  0
Fe:  9    Ti:  5    Mg:  2    Na:  0    P :  3    Cu:  4
Ce:  0    Zn:  1    Ba:  5    Pb:  1
AVE DIA=       11.42 uM  MAX DIA=       18.45 uM  MIN DIA=        4.83 uM
AREA=     123.40 uM^2  PERIMETER=       75.58 uM  SHAPE FACTOR=   3.683

PART NO:   988  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      992
ELEMENT CONCENTRATIONS:
Al: 47    Si: 42    S :  0    K :  0    Ca:  0    Cl:  2
Fe:  1    Ti:  4    Mg:  0    Na:  1    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=       12.74 uM  MAX DIA=       19.33 uM  MIN DIA=        6.59 uM
AREA=     131.41 uM^2  PERIMETER=       62.84 uM  SHAPE FACTOR=   2.390

PART NO:   991  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      290
ELEMENT CONCENTRATIONS:
Al: 36    Si:  0    S :  7    K :  1    Ca: 24    Cl:  2
Fe:  0    Ti:  8    Mg:  1    Na:  3    P :  0    Cu:  0
Ce:  6    Zn:  4    Ba:  0    Pb:  2
AVE DIA=       18.45 uM  MAX DIA=       26.36 uM  MIN DIA=        2.63 uM
AREA=     256.75 uM^2  PERIMETER=      132.71 uM  SHAPE FACTOR=   5.458

PART NO:   992  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1026
ELEMENT CONCENTRATIONS:
Al: 39    Si: 18    S :  1    K :  4    Ca: 23    Cl:  2
Fe:  0    Ti:  0    Mg:  0    Na:  1    P :  1    Cu:  0
Ce:  2    Zn:  1    Ba:  1    Pb:  0
AVE DIA=        7.03 uM  MAX DIA=       12.74 uM  MIN DIA=        5.27 uM
AREA=      39.78 uM^2  PERIMETER=       32.08 uM  SHAPE FACTOR=   2.058

PART NO:   995  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      861
ELEMENT CONCENTRATIONS:
Al: 60    Si: 18    S :  1    K :  0    Ca:  3    Cl:  1
Fe:  3    Ti:  1    Mg:  3    Na:  0    P :  0    Cu:  2
Ce:  0    Zn:  1    Ba:  2    Pb:  0
AVE DIA=        6.59 uM  MAX DIA=       11.42 uM  MIN DIA=        4.39 uM
AREA=      38.33 uM^2  PERIMETER=       29.88 uM  SHAPE FACTOR=   1.853

PART NO:  1003  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      487
ELEMENT CONCENTRATIONS:
Al: 10    Si: 32    S :  0    K :  4    Ca: 14    Cl: 12
Fe: 11    Ti:  6    Mg:  5    Na:  0    P :  0    Cu:  0
Ce:  2    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        5.27 uM  MAX DIA=        7.03 uM  MIN DIA=        3.95 uM
AREA=      24.42 uM^2  PERIMETER=       21.53 uM  SHAPE FACTOR=   1.510
```

```
PART NO:  1004  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      603
ELEMENT CONCENTRATIONS:
Al: 53    Si: 34    S :  2    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  2    Mg:  0    Na:  2    P :  0    Cu:  0
Ce:  2    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        6.59 uM  MAX DIA=       13.62 uM  MIN DIA=        1.75 uM
AREA=       37.75 uM^2  PERIMETER=       54.49 uM  SHAPE FACTOR=   6.257

PART NO:  1013  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      436
ELEMENT CONCENTRATIONS:
Al: 63    Si: 26    S :  0    K :  0    Ca:  0    Cl:  3
Fe:  0    Ti:  1    Mg:  0    Na:  0    P :  1    Cu:  0
Ce:  0    Zn:  0    Ba:  0    Pb:  3
AVE DIA=       11.42 uM  MAX DIA=       22.85 uM  MIN DIA=        6.15 uM
AREA=      112.58 uM^2  PERIMETER=       64.59 uM  SHAPE FACTOR=   2.949

PART NO:  1022  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      692
ELEMENT CONCENTRATIONS:
Al: 50    Si: 33    S :  0    K :  3    Ca:  2    Cl:  0
Fe:  0    Ti:  1    Mg:  0    Na:  0    P :  0    Cu:  2
Ce:  4    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       10.98 uM  MAX DIA=       14.94 uM  MIN DIA=        9.66 uM
AREA=      105.15 uM^2  PERIMETER=       40.86 uM  SHAPE FACTOR=   1.263

PART NO:  1031  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      507
ELEMENT CONCENTRATIONS:
Al: 40    Si: 41    S :  1    K :  0    Ca:  7    Cl:  0
Fe:  0    Ti:  0    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  3    Zn:  0    Ba:  3    Pb:  0
AVE DIA=        6.15 uM  MAX DIA=       13.62 uM  MIN DIA=        2.19 uM
AREA=       37.36 uM^2  PERIMETER=       43.06 uM  SHAPE FACTOR=   3.949

PART NO:  1036  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     1399
ELEMENT CONCENTRATIONS:
Al: 16    Si: 23    S :  0    K :  0    Ca:  2    Cl:  0
Fe:  0    Ti: 45    Mg:  2    Na:  0    P :  0    Cu:  0
Ce:  6    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        7.03 uM  MAX DIA=       12.74 uM  MIN DIA=        3.07 uM
AREA=       61.60 uM^2  PERIMETER=       37.35 uM  SHAPE FACTOR=   1.802

PART NO:  1040  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:      682
ELEMENT CONCENTRATIONS:
Al: 22    Si: 54    S :  0    K :  2    Ca:  0    Cl:  6
Fe:  4    Ti:  1    Mg:  0    Na:  0    P :  2    Cu:  0
Ce:  2    Zn:  2    Ba:  0    Pb:  0
AVE DIA=        7.91 uM  MAX DIA=       11.42 uM  MIN DIA=        2.63 uM
AREA=       60.63 uM^2  PERIMETER=       44.82 uM  SHAPE FACTOR=   2.636
```

```
PART NO:  1047  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:    1126
ELEMENT CONCENTRATIONS:
Al: 29    Si: 55    S :  0    K :  0    Ca:  0    Cl:  2
Fe:  3    Ti:  4    Mg:  0    Na:  0    P :  2    Cu:  1
Ce:  0    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        6.15 uM  MAX DIA=        6.59 uM  MIN DIA=        5.27 uM
AREA=      33.89 uM^2  PERIMETER=       23.73 uM  SHAPE FACTOR=   1.322

PART NO:  1072  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     468
ELEMENT CONCENTRATIONS:
Al: 48    Si: 21    S :  9    K :  1    Ca:  7    Cl:  0
Fe:  0    Ti:  0    Mg:  1    Na:  0    P :  0    Cu:  0
Ce:  0    Zn:  0    Ba:  8    Pb:  1
AVE DIA=        7.47 uM  MAX DIA=       18.45 uM  MIN DIA=        3.07 uM
AREA=      46.25 uM^2  PERIMETER=       50.53 uM  SHAPE FACTOR=   4.393

PART NO:  1081  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     953
ELEMENT CONCENTRATIONS:
Al: 57    Si: 32    S :  1    K :  0    Ca:  0    Cl:  0
Fe:  0    Ti:  0    Mg:  0    Na:  3    P :  1    Cu:  0
Ce:  0    Zn:  1    Ba:  0    Pb:  0
AVE DIA=       10.98 uM  MAX DIA=       24.16 uM  MIN DIA=        2.63 uM
AREA=     140.30 uM^2  PERIMETER=       71.19 uM  SHAPE FACTOR=   2.874

PART NO:  1083  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     275
ELEMENT CONCENTRATIONS:
Al: 54    Si:  7    S :  0    K :  0    Ca:  0    Cl:  6
Fe:  7    Ti:  0    Mg:  0    Na:  3    P :  5    Cu:  0
Ce:  6    Zn:  4    Ba:  0    Pb:  5
AVE DIA=       10.10 uM  MAX DIA=       16.25 uM  MIN DIA=        5.71 uM
AREA=      91.92 uM^2  PERIMETER=       58.00 uM  SHAPE FACTOR=   2.912

PART NO:  1087  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     636
ELEMENT CONCENTRATIONS:
Al: 26    Si: 50    S :  1    K :  0    Ca:  0    Cl:  0
Fe:  5    Ti:  3    Mg:  4    Na:  2    P :  0    Cu:  1
Ce:  0    Zn:  0    Ba:  0    Pb:  1
AVE DIA=        5.27 uM  MAX DIA=        6.59 uM  MIN DIA=        3.95 uM
AREA=      24.04 uM^2  PERIMETER=       22.85 uM  SHAPE FACTOR=   1.728

PART NO:  1105  DATA BASE NO: 1    NAME: UNKNOWN
TOTAL XRAY COUNTS:     393
ELEMENT CONCENTRATIONS:
Al: 44    Si: 14    S :  0    K : 14    Ca:  0    Cl:  3
Fe:  9    Ti:  3    Mg:  0    Na:  0    P :  4    Cu:  1
Ce:  4    Zn:  0    Ba:  0    Pb:  0
AVE DIA=        5.27 uM  MAX DIA=       19.33 uM  MIN DIA=        2.63 uM
AREA=      27.13 uM^2  PERIMETER=       44.38 uM  SHAPE FACTOR=   5.776
```

```
PART NO:  1111  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      252
ELEMENT CONCENTRATIONS:
Al: 44    Si:  7    S :  0    K :  0    Ca:  0    Cl:  3
Fe: 14    Ti:  2    Mg:  2    Na:  0    P :  0    Cu:  4
Ce:  5    Zn:  0    Ba:  9    Pb:  3
AVE DIA=       15.82 uM  MAX DIA=       20.21 uM  MIN DIA=       12.74 uM
AREA=      201.[illegible]0 uM^2  PERIMETER=       74.70 uM  SHAPE FACTOR=   2.200

PART NO:  1117  DATA BASE NO: 1     NAME: UNKNOWN
TOTAL XRAY COUNTS:      639
ELEMENT CONCENTRATIONS:
Al:  5    Si: 17    S :  0    K :  1    Ca: 42    Cl:  0
Fe:  5    Ti:  5    Mg:  0    Na:  2    P : 13    Cu:  1
Ce:  0    Zn:  0    Ba:  2    Pb:  2
AVE DIA=        7.03 uM  MAX DIA=       10.98 uM  MIN DIA=        2.63 uM
AREA=       42.29 uM^2  PERIMETER=       39.55 uM  SHAPE FACTOR=   2.942




                ***  SUMMARY OF RESULTS  ***

NO. OF PARTICLES:              277            24.73 % TOTAL NO. PARTICLES
TOTAL AREA SCANNED:      3.238E+06 uM^2       1.515 % TOTAL AREA SCANNED
TOTAL MASS CONTRIBUTED: 1.515E-02 G/CM^3

AVERAGE SIZE PARAMETERS
PARAMETER         AVERAGE       STANDARD DEV.
AVE DIAMETER       12.57 uM          6.60 uM
MAX DIAMETER       23.61 uM         12.70 uM
MIN DIAMETER        6.40 uM          4.28 uM
AREA              177.22 uM^2      194.73 uM^2
PERIMETER          71.18 uM         37.19 uM
SHAPE FACTOR      2.9481            1.2022

AVERAGE CHEMISTRY
      ELEMENTS
    | Al | Si | S  | K  | Ca | Cl | Fe | Ti | Mg | Na | P  | Cu | Ce | Zn | Ba | Pb |
    ------------------------------------------------------------------------------
AVE | 37 | 33 |  3 |  2 |  4 |  2 |  5 |  3 |  1 |  1 |  2 |  2 |  2 |  1 |  2 |  1 |
STD | 16 | 19 |  4 |  3 |  7 |  3 |  8 |  5 |  2 |  1 |  3 |  2 |  3 |  2 |  3 |  2 |
                                                  MAGNIFICATION=            500
SUMMARY OF RESULTS                                GUARD REGION=           4.000 microns
                                                  MINIMUM PARTICLE SIZE=  0.500 microns
LABEL: 85-197-P587-200-1100-0-500XDB              MAXIMUM PARTICLE SIZE=  7.500 microns
NUMBER OF FRAMES              1                   LOW SHAPE FACTOR=       1.000
NUMBER OF PARTICLES         512                   HIGH SHAPE FACTOR=      7.000
MAGNIFICATION               500
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um                  THRESHOLDS:  LOWER=  88  UPPER= 255
ON PARTICLE SPACING=       0.04 um
FIELD AREA=          3.23E+04 um^2
TYPE          NAME                AVE.DIA.                MAX        MAX/MIN      AREA       PERIMETER
                                  MICRONS                 MICRONS                 uM^2       MICRONS
  0  ALL TYPES              2.79E+00 +-  2.87E+00    4.89E+00    3.24E+00   1.372E+01   1.355E+01
  2  KAOLINITE              2.80E+00 +-  1.66E+00    5.04E+00    2.98E+00   9.346E+00   1.296E+01
  3  ILLITE                 1.92E+00 +-  1.51E+00    2.97E+00    2.37E+00   4.789E+00   8.353E+00
  4  QUARTZ                 3.93E+00 +-  5.73E+00    5.82E+00    2.36E+00   4.064E+01   1.594E+01
  5  SIDERITE               2.59E+00 +-  0.00E+00    3.16E+00    1.43E+00   5.273E+00   8.525E+00
  7  ANKERITE               1.62E+00 +-  0.00E+00    2.81E+00    2.20E+00   2.165E+00   6.547E+00
 16  MONAZITE               1.27E+00 +-  8.07E-01    2.02E+00    2.15E+00   1.606E+00   6.064E+00
 22  ILLITE + Ti            2.70E+00 +-  8.29E-01    3.60E+00    1.72E+00   6.307E+00   9.873E+00
 23  ZIRCON                 1.70E+00 +-  1.69E+00    3.71E+00    3.66E+00   4.819E+00   1.015E+01
 24  POLISH                 4.48E+00 +-  3.53E+00    7.43E+00    3.24E+00   2.698E+01   2.126E+01
 62  NON-INT                2.29E+00 +-  2.20E+00    4.39E+00    3.94E+00   8.856E+00   1.262E+01
 63  UNKNOWN                2.12E+00 +-  2.13E+00    3.93E+00    3.27E+00   7.989E+00   1.073E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                      512     100.00      21.70
  2  KAOLINITE                       69      13.47       1.99
  3  ILLITE                          21       4.10       0.31
  4  QUARTZ                          32       6.25       4.01
  5  SIDERITE                         1       0.19       0.01
  7  ANKERITE                         1       0.19       0.00
 16  MONAZITE                         2       0.39       0.00
 22  ILLITE + Ti                      3       0.58       0.05
 23  ZIRCON                           9       1.75       0.13
 24  POLISH                          97      18.94       8.08
 62  NON-INT                         92      17.96       2.51
 63  UNKNOWN                        185      36.13       4.56











FILE NO.?14
DRIVE NO.?2
LABEL: P587-200-1100-0X500D
NO. OF VIDEO SAMPLES    32?
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      65  12.6 [*******
     1.00      48   9.3 [*****
     1.25      60  11.7 [******
     1.50      45   8.7 [*****
     1.75      32   6.2 [****
     2.00      35   6.8 [****
     2.25      25   4.8 [***
     2.50      20   3.9 [**
     2.75      15   2.9 [**
     3.00      12   2.3 [**
     3.25      13   2.5 [**
     3.50      14   2.7 [**
     3.75      16   3.1 [**
     4.00      10   1.9 [*
     4.25       9   1.7 [*
     4.50       7   1.3 [*
     4.75       4   0.7 [*
     5.00       6   1.1 [*
     5.25       7   1.3 [*
     5.50       7   1.3 [*
     5.75       4   0.7 [*
     6.00       5   0.9 [*
     6.25       5   0.9 [*
     6.50       1   0.1 [*
     6.75       3   0.5 [*
     7.00       7   1.3 [*
     7.25       1   0.1 [*
     7.50      36   7.0 [****

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       4   5.7 [***
     1.00       2   2.8 [**
     1.25       5   7.2 [****
     1.50       5   7.2 [****
     1.75       3   4.3 [***
     2.00       8  11.5 [******
     2.25       6   8.6 [*****
     2.50       5   7.2 [****
     2.75       2   2.8 [**
     3.00       2   2.8 [**
     3.25       3   4.3 [***
     3.50       6   8.6 [*****
     3.75       3   4.3 [***
     4.00       1   1.4 [*
     4.25       2   2.8 [**
     4.50       1   1.4 [*
     4.75       0   0.0 [
     5.00       2   2.8 [**
     5.25       2   2.8 [**
     5.50       1   1.4 [*
     5.75       2   2.8 [**
     6.00       2   2.8 [**
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       1   1.4 [*
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       1   1.4 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        0   0.0 [
     1.00        0   0.0 [
     1.25        0   0.0 [
     1.50        0   0.0 [
     1.75        0   0.0 [
     2.00        0   0.0 [
     2.25        0   0.0 [
     2.50        0   0.0 [
     2.75        1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   7   NAME: ANKERITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        0   0.0 [
     1.00        0   0.0 [
     1.25        0   0.0 [
     1.50        0   0.0 [
     1.75        1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        1  50.0 [*************************
     1.00        0   0.0 [
     1.25        0   0.0 [
     1.50        0   0.0 [
     1.75        0   0.0 [
     2.00        1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     0.25        0   0.0 [
     0.50        0   0.0 [
     0.75        0   0.0 [
     1.00        0   0.0 [
     1.25        0   0.0 [
     1.50        0   0.0 [
     1.75        0   0.0 [
     2.00        1  33.3 [*****************
     2.25        0   0.0 [
     2.50        0   0.0 [
     2.75        0   0.0 [
     3.00        1  33.3 [*****************
     3.25        0   0.0 [
     3.50        1  33.3 [*****************
     3.75        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2   9.5 [*****
     1.00       2   9.5 [*****
     1.25       4  19.0 [**********
     1.50       2   9.5 [*****
     1.75       2   9.5 [*****
     2.00       2   9.5 [*****
     2.25       3  14.2 [********
     2.50       1   4.7 [***
     2.75       0   0.0 [
     3.00       1   4.7 [***
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       1   4.7 [***
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       1   4.7 [***

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2   6.2 [****
     1.00       2   6.2 [****
     1.25       4  12.5 [*******
     1.50       5  15.6 [********
     1.75       4  12.5 [*******
     2.00       0   0.0 [
     2.25       1   3.1 [**
     2.50       3   9.3 [*****
     2.75       2   6.2 [****
     3.00       1   3.1 [**
     3.25       1   3.1 [**
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       1   3.1 [**
     4.50       1   3.1 [**
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       1   3.1 [**
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       4  12.5 [*******
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       4  44.4 [***********************
     1.00       1  11.1 [******
     1.25       1  11.1 [******
     1.50       1  11.1 [******
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       1  11.1 [******
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       1  11.1 [******
     5.75       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       7   7.2 [****
     1.00       4   4.1 [***
     1.25       6   6.1 [****
     1.50       2   2.0 [**
     1.75       5   5.1 [***
     2.00       5   5.1 [***
     2.25       2   2.0 [**
     2.50       4   4.1 [***
     2.75       1   1.0 [*
     3.00       5   5.1 [***
     3.25       3   3.0 [**
     3.50       2   2.0 [**
     3.75       6   6.1 [****
     4.00       5   5.1 [***
     4.25       2   2.0 [**
     4.50       2   2.0 [**
     4.75       4   4.1 [***
     5.00       0   0.0 [
     5.25       2   2.0 [**
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       3   3.0 [**
     6.25       1   1.0 [*
     6.50       1   1.0 [*
     6.75       0   0.0 [
     7.00       5   5.1 [***
     7.25       0   0.0 [
     7.50      20  20.6 [***********
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      15  16.3 [*********
     1.00      14  15.2 [********
     1.25      11  11.9 [******
     1.50       9   9.7 [*****
     1.75       3   3.2 [**
     2.00       5   5.4 [***
     2.25       7   7.6 [****
     2.50       2   2.1 [**
     2.75       3   3.2 [**
     3.00       1   1.0 [*
     3.25       3   3.2 [**
     3.50       2   2.1 [**
     3.75       3   3.2 [**
     4.00       1   1.0 [*
     4.25       1   1.0 [*
     4.50       1   1.0 [*
     4.75       0   0.0 [
     5.00       2   2.1 [**
     5.25       0   0.0 [
     5.50       1   1.0 [*
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       1   1.0 [*
     6.50       0   0.0 [
     6.75       1   1.0 [*
     7.00       0   0.0 [
     7.25       1   1.0 [*
     7.50       5   5.4 [***

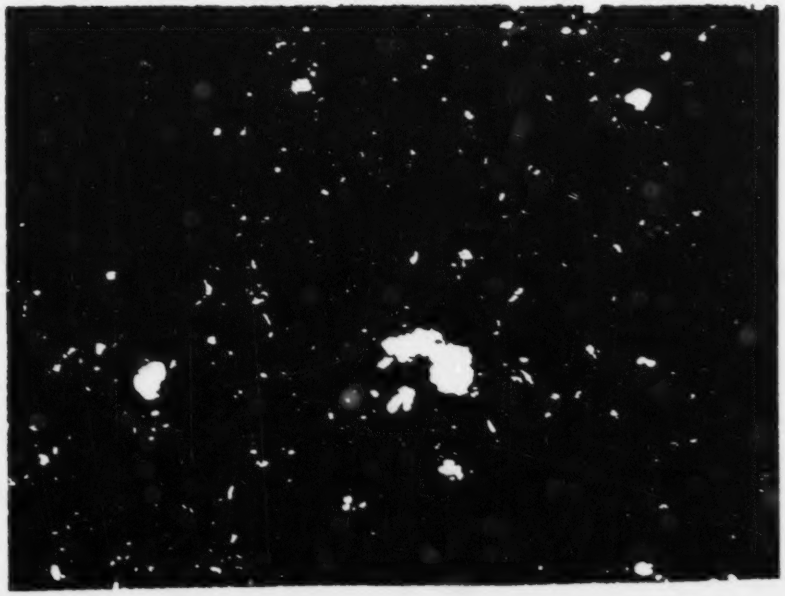
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      30  16.2 [*********
     1.00      23  12.4 [*******
     1.25      29  15.6 [********
     1.50      21  11.3 [******
     1.75      14   7.5 [****
     2.00      13   7.0 [****
     2.25       6   3.2 [**
     2.50       5   2.7 [**
     2.75       6   3.2 [**
     3.00       1   0.5 [*
     3.25       3   1.6 [*
     3.50       3   1.6 [*
     3.75       3   1.6 [*
     4.00       3   1.6 [*
     4.25       3   1.6 [*
     4.50       1   0.5 [*
     4.75       0   0.0 [
     5.00       2   1.0 [*
     5.25       3   1.6 [*
     5.50       4   2.1 [**
     5.75       2   1.0 [*
     6.00       0   0.0 [
     6.25       2   1.0 [*
     6.50       0   0.0 [
     6.75       1   0.5 [*
     7.00       2   1.0 [*
     7.25       0   0.0 [
     7.50       5   2.7 [**
```

PHOTOMICROGRAPHS PLATE #10
Combustion Residue: 850°C, reducing atmosphere

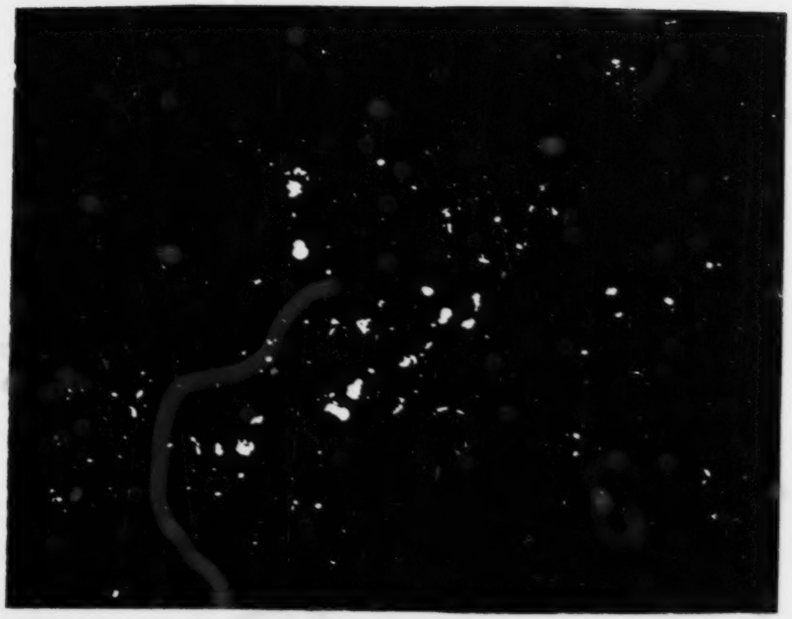
Eastern Coal: P743 -200 mesh

1.	0521-01	35X, BEI. Low magnification view of highest mineralized field. Ash mounted as leucite pellet, carbon coated.
2.	0521-02	150X, BEI. Enlarged from above. Note minor vesicles. Unaltered minerals.
3.	0521-04	150X. BEI. Enlarged from #1.
4.	0521-03	150X, BEI. Enlarged from #1. Relatively unaltered mineralogy
5.	0521-09	350X, BEI. Enlarged from #3. Minerals remain encapsulated: quartz (Q), illite (I), chlorite, mixed clays (?).
6.	0521-05	350X, BEI. Enlarged #2. Minerals identified: illite, pyrite.
7.	0521-07	350X, BEI. Enlarged #4. Bright twin lobes are pyrite framboids (F) that survived combustion. Note aluminium polish (X). Other minerals: illite.
8.	0521-08	350X, SEI. Same view. Note vesicles and "plucked" nature of sample.
9.	0521-10	350X, SEI. Same view as #5. Note angular fragments, severe pitting ("plucking") of sample. Vesicular textures are confirmed.
10.	0521-06	350X, SEI. Same view as #6. Again, the sample topography illustrates sever "plucking" and a friable nature.

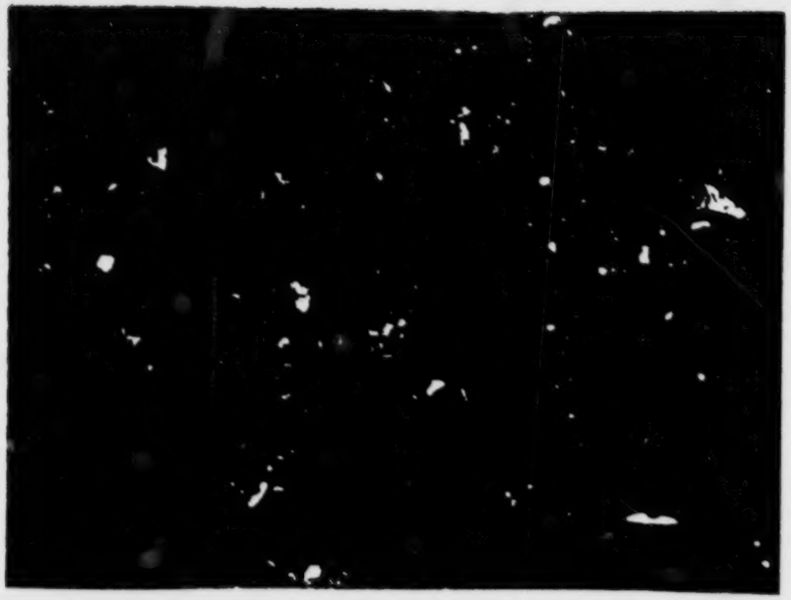
1


2

3

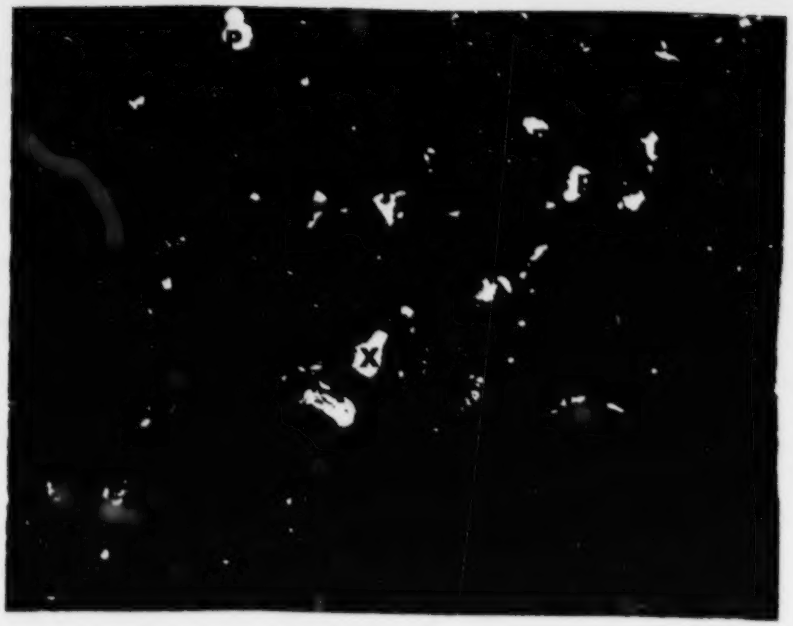

4

5

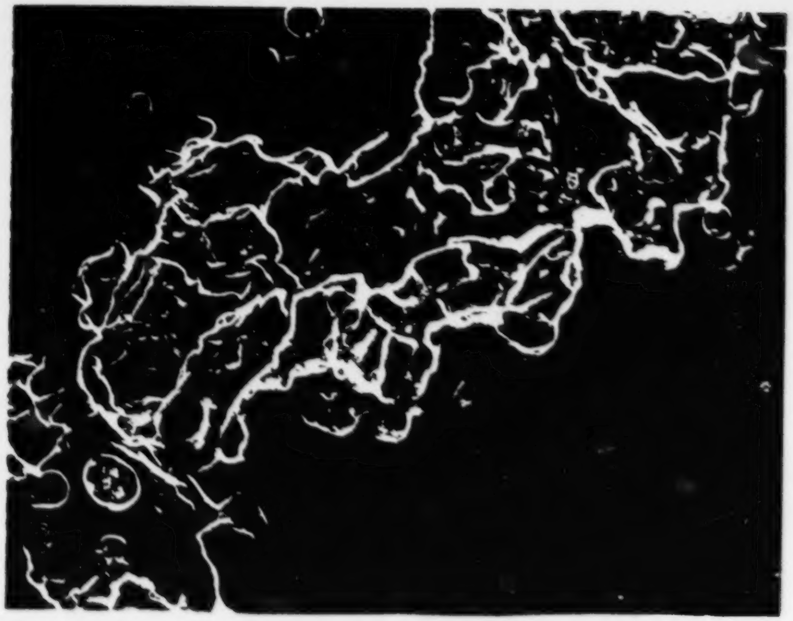


6

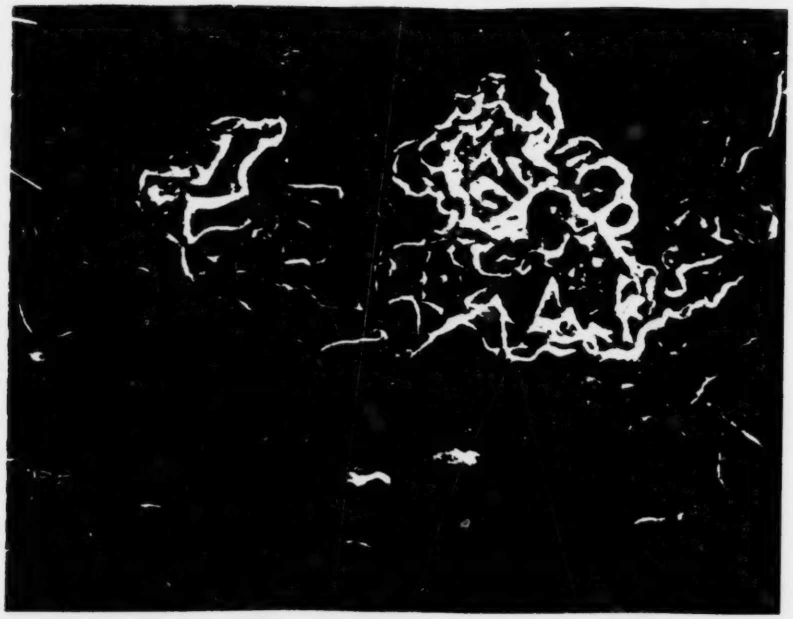
7



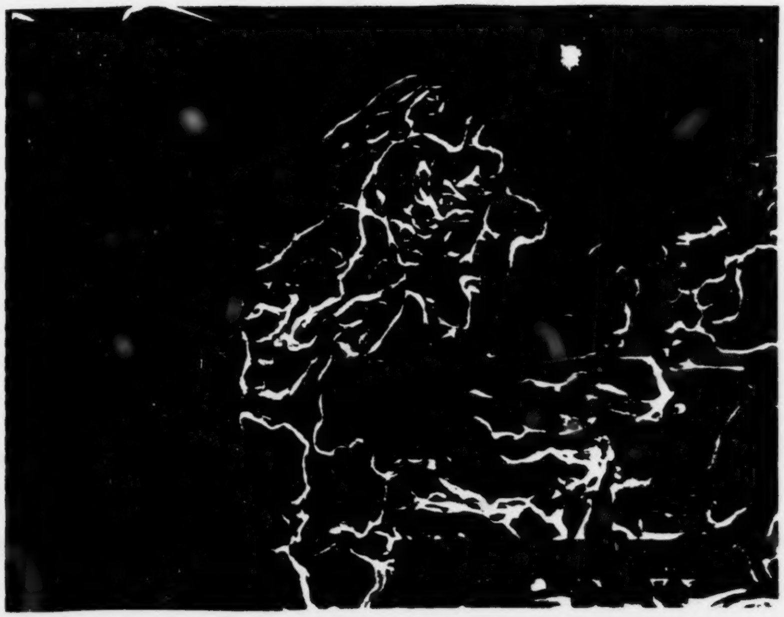
8



9



10



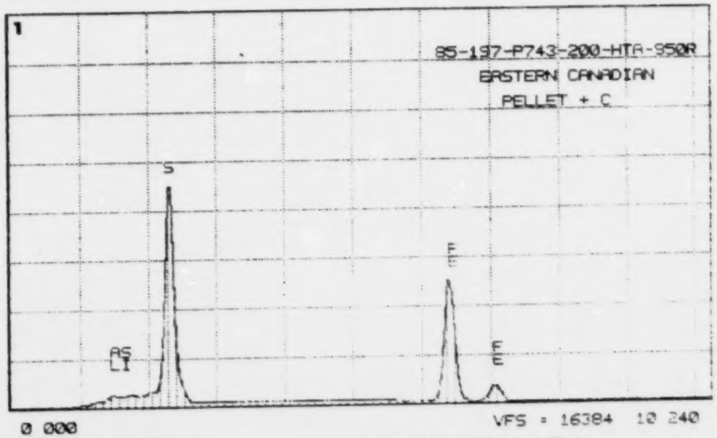
EDX SPECTRA SET #10
Combustion Residue 850°C, reducing

Eastern Canadian Coal: P743 -200 mesh

1. Pyrite
2. Illite (?) or kaolinite, but note presence of sodium. This may be a mixed layer clay.
3. "Coke" matrix: High **Bremsstrahlung**, indicating incomplete combustion. This spectrum differs little from typical bituminous coal.
4. "Coke" matrix (B): Note high organic S, and presence of potassium which should flux the clays.
5. Quartz with trace polish (Al).
6. Iron oxide (magnetite?) or siderite. As an isolated grain, this may be a thermal product (magnetite) from pyrite decomposition.
7. Illite (?) or kaolinite. As for EDX #2, the presence of Na and K is problematic. This may be a mixed layer clay.
8. Chlorite (?)
9. Quartz.

?

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:46
Cursor: 0.000keV = 0



0 000 VFS = 16384 10 240
50 MINERAL: PHOTO# 0521-05.EDX1

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:51
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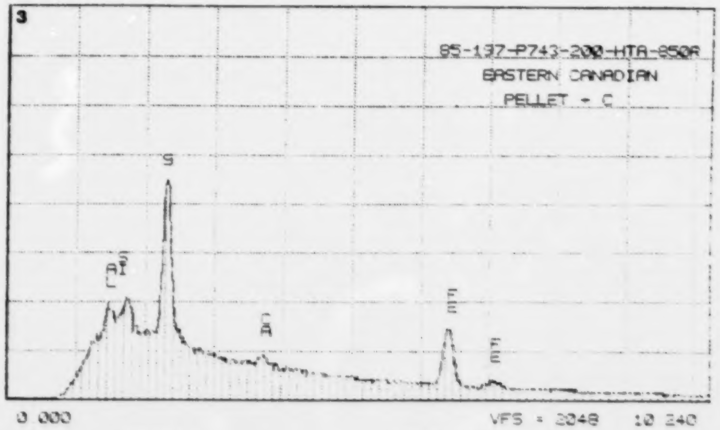

0 000 VFS = 2048 10 240
50 MATRIX PHOTO# 0521-05.EDX3

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:48
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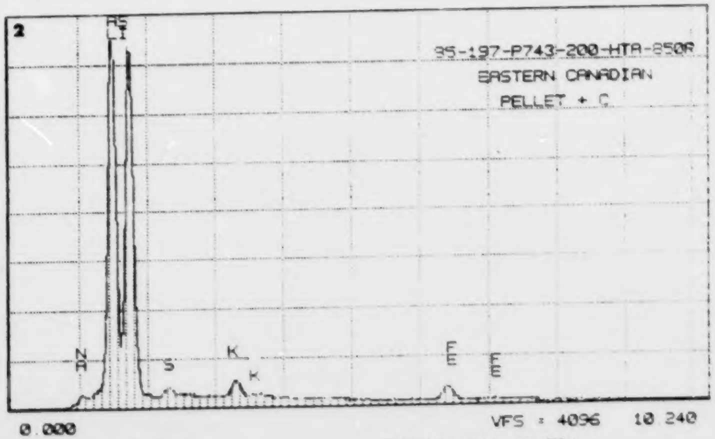

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50 MINERAL: PHOTO# 0521-05.EDX

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:53
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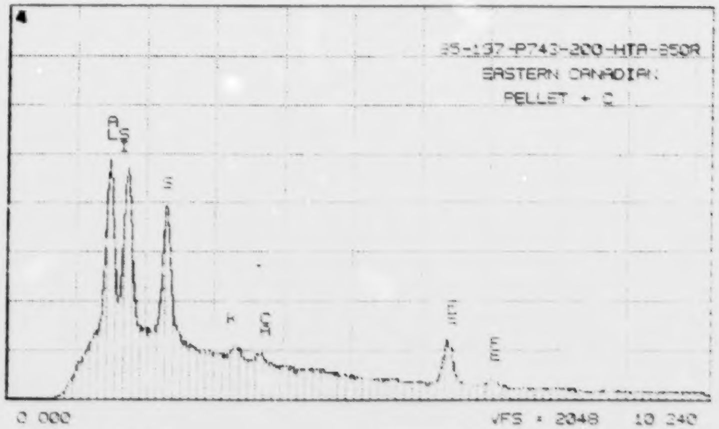

0 000 VFS = 2048 10 240
50 MATRIX PHOTO# 0521-07.EDX4

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:55
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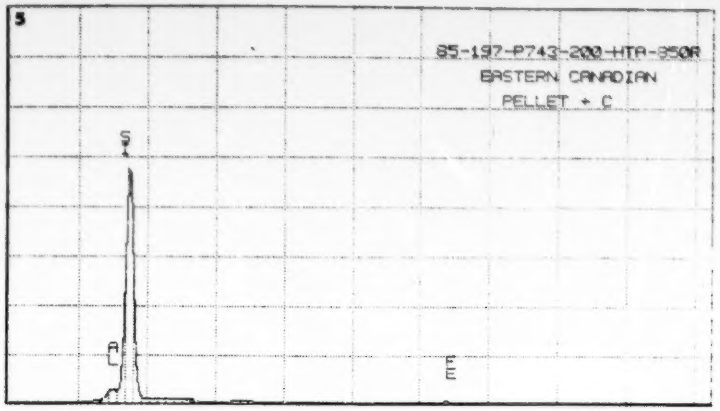
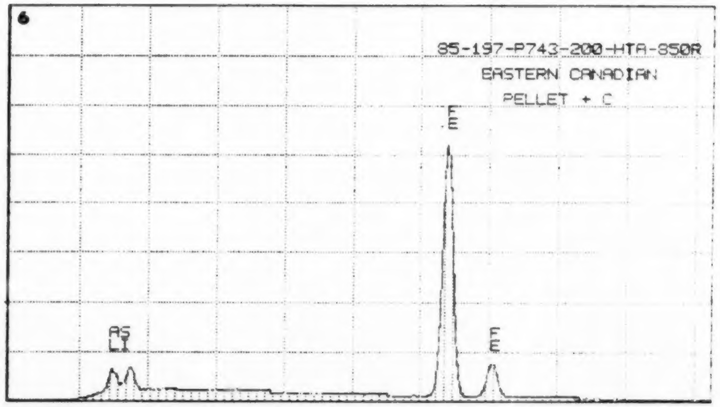


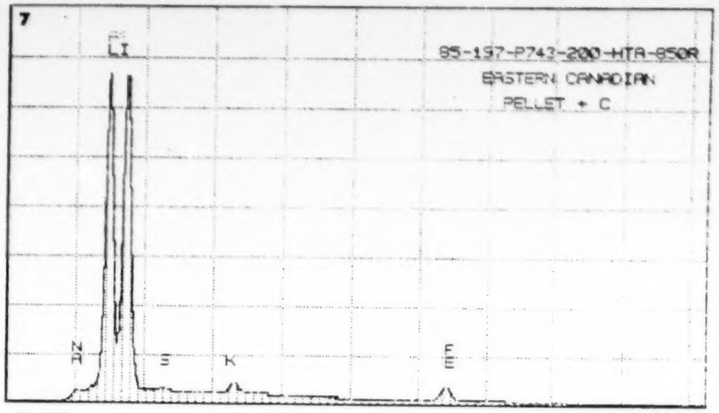
0.000 VFS = 32768 10.240
50 MINERAL: PHOTO# 0521-09.EDX5

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:57
Cursor: 0.000keV = 0



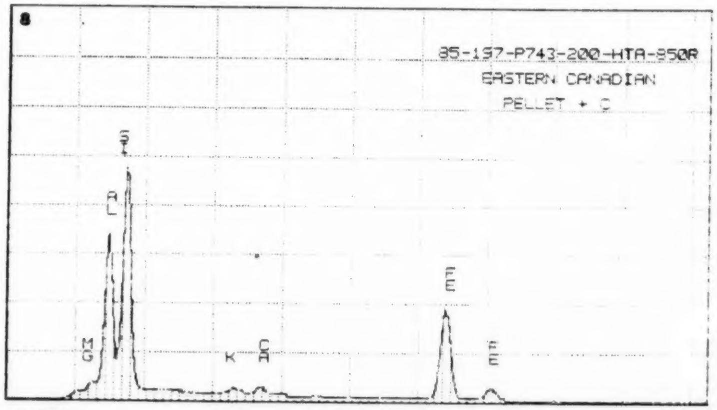
0.000 VFS = 16384 10.240
50 MINERAL: PHOTO# 0521-09.EDX6

ATLANTIC COAL INSTITUTE THU 22-MAY-86 09:59
Cursor: 0.000keV = 0



0.000 VFS = 8192 10.240
50 MINERAL: PHOTO# 0521-09.EDX7

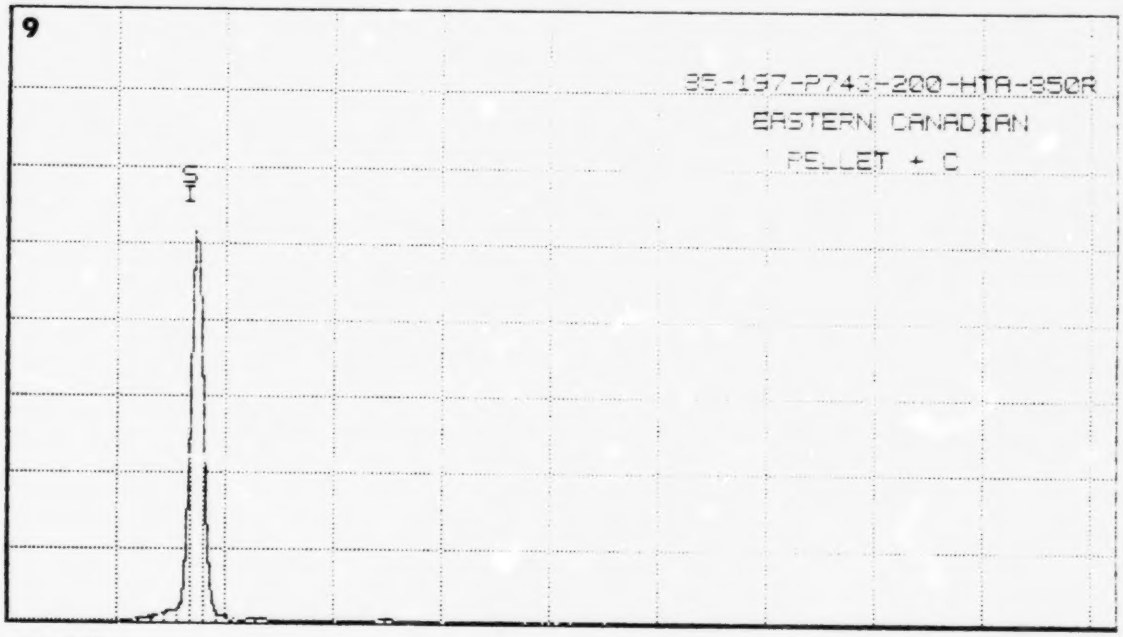
ATLANTIC COAL INSTITUTE THU 22-MAY-86 10:01
Cursor: 0.000keV = 0



0.000 VFS = 16384 10.240
50 MINERAL: PHOTO# 0521-09.EDX8

ATLANTIC COAL INSTITUTE
Cursor: 0.000keV = 0

THU 22-MAY-86 10:04



0.000
VFS = 32768 10.240

50 MINERAL: Q

PHOTO# 0521-09.EDX9

```
PRC: REP

                                              LABEL: 85-197-P743-20-HTA-850R  50X (5-30)
                                              MAGNIFICATION=                50
SUMMARY OF RESULTS                            GUARD REGION=              12.000 microns
                                              MINIMUM PARTICLE SIZE=      5.000 microns
                                              MAXIMUM PARTICLE SIZE=     30.000 microns
LABEL: 85-197-P743-20-HTA-850R  50X (5-30)    LOW SHAPE FACTOR=           1.000
NUMBER OF FRAMES              3               HIGH SHAPE FACTOR=          7.000
NUMBER OF PARTICLES         610
MAGNIFICATION                50
FIELD WIDTH=            1799.56 um
OFF PARTICLE SPACING=      4.83 um
ON PARTICLE SPACING=       0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE          NAME                   AVE.DIA.                MAX        MAX/MIN      AREA       PERIMETER
                                     MICRONS                 MICRONS                 uM^2       MICRONS
  0  ALL TYPES               1.07E+01 +-  6.49E+00     1.79E+01     3.13E+00   1.353E+02   5.109E+01
  1  PYRITE                  1.12E+01 +-  9.00E+00     1.71E+01     1.99E+00   1.513E+02   4.438E+01
  2  KAOLINITE               1.06E+01 +-  5.77E+00     1.53E+01     2.27E+00   1.231E+02   4.293E+01
  3  ILLITE                  8.60E+00 +-  3.89E+00     1.40E+01     2.87E+00   7.783E+01   3.818E+01
  4  QUARTZ                  1.08E+01 +-  7.32E+00     1.63E+01     2.37E+00   1.397E+02   4.353E+01
  5  SIDERITE                9.33E+00 +-  3.35E+00     1.37E+01     1.96E+00   8.535E+01   3.817E+01
 14  RUTILE                  1.31E+01 +-  0.00E+00     1.88E+01     1.95E+00   1.468E+02   4.877E+01
 21  FeS (?)                 1.17E+01 +-  8.41E+00     1.56E+01     2.05E+00   1.659E+02   4.624E+01
 22  POLISH                  9.39E+00 +-  6.55E+00     1.47E+01     2.93E+00   1.107E+02   4.291E+01
 62  NON-INT                 1.23E+01 +-  6.58E+00     2.22E+01     3.58E+00   1.708E+02   6.307E+01
 63  UNKNOWN                 1.06E+01 +-  5.97E+00     1.78E+01     3.20E+00   1.269E+02   5.031E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                       610     100.00       0.84
  1  PYRITE                            4       0.65       0.00
  2  KAOLINITE                        20       3.27       0.02
  3  ILLITE                           28       4.59       0.02
  4  QUARTZ                           18       2.95       0.02
  5  SIDERITE                          8       1.31       0.00
 14  RUTILE                            1       0.16       0.00
 21  FeS (?)                           9       1.47       0.01
 22  POLISH                          208      34.09       0.23
 62  NON-INT                         218      35.73       0.38
 63  UNKNOWN                          96      15.73       0.12


    LABEL: 743-20-850R-50X
    NO. OF VIDEO SAMPLES   32?

     FILE NO.?22


  THRESHOLDS:  LOWER=  85  UPPER= 255

  FRAME NO.    1
  TOTAL NO OF PARTICLES FOR FRAME=  145

 THRESHOLDS:  LOWER=  76  UPPER= 255

 FRAME NO.    2
 TOTAL NO OF PARTICLES FOR FRAME=  174

  THRESHOLDS:  LOWER=  76  UPPER= 255

  FRAME NO.    3
  TOTAL NO OF PARTICLES FOR FRAME=  291
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      70  12.7 [*******
     7.00      80  13.1 [*******
     8.00     109  17.8 [*********
     9.00      63  10.3 [******
    10.00      43   7.0 [****
    11.00      49   8.0 [*****
    12.00      19   3.1 [**
    13.00      24   3.9 [**
    14.00      18   2.9 [**
    15.00      20   3.2 [**
    16.00      12   1.9 [*
    17.00      12   1.9 [*
    18.00      14   2.2 [**
    19.00      15   2.4 [**
    20.00       9   1.4 [*
    21.00       7   1.1 [*
    22.00      10   1.6 [*
    23.00       2   0.3 [*
    24.00       4   0.6 [*
    25.00       2   0.3 [*
    26.00       2   0.3 [*
    27.00       4   0.6 [*
    28.00       1   0.1 [*
    29.00       1   0.1 [*
    30.00      12   1.9 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  25.0 [*************
     7.00       0   0.0 [
     8.00       2  50.0 [**************************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       1  25.0 [*************
    26.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       4  20.0 [************
     7.00       3  15.0 [*********
     8.00       4  20.0 [************
     9.00       1   5.0 [***
    10.00       0   0.0 [
    11.00       1   5.0 [***
    12.00       1   5.0 [***
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       1   5.0 [***
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       2  10.0 [******
    19.00       1   5.0 [***
    20.00       0   0.0 [
    21.00       1   5.0 [***
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       1   5.0 [***
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       5  17.8 [**********
     7.00       7  25.0 [***************
     8.00       5  17.8 [**********
     9.00       3  10.7 [******
    10.00       3  10.7 [******
    11.00       2   7.1 [****
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       1   3.5 [**
    18.00       0   0.0 [
    19.00       1   3.5 [**
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       1   3.5 [**
    23.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       3  16.6 [*********
     7.00       4  22.2 [************
     8.00       3  16.6 [*********
     9.00       1   5.5 [***
    10.00       1   5.5 [***
    11.00       1   5.5 [***
    12.00       1   5.5 [***
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       1   5.5 [***
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       1   5.5 [***
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       1   5.5 [***
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   5.5 [***

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  12.5 [*******
     7.00       1  12.5 [*******
     8.00       1  12.5 [*******
     9.00       1  12.5 [*******
    10.00       1  12.5 [*******
    11.00       1  12.5 [*******
    12.00       1  12.5 [*******
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       1  12.5 [*******
    17.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        0   0.0 [
     7.00        0   0.0 [
     8.00        0   0.0 [
     9.00        0   0.0 [
    10.00        0   0.0 [
    11.00        0   0.0 [
    12.00        0   0.0 [
    13.00        0   0.0 [
    14.00        1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00        2  22.2 [************
     7.00        1  11.1 [******
     8.00        2  22.2 [************
     9.00        1  11.1 [******
    10.00        0   0.0 [
    11.00        0   0.0 [
    12.00        0   0.0 [
    13.00        0   0.0 [
    14.00        0   0.0 [
    15.00        1  11.1 [******
    16.00        0   0.0 [
    17.00        0   0.0 [
    18.00        0   0.0 [
    19.00        0   0.0 [
    20.00        1  11.1 [******
    21.00        0   0.0 [
    22.00        0   0.0 [
    23.00        0   0.0 [
    24.00        0   0.0 [
    25.00        0   0.0 [
    26.00        0   0.0 [
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        0   0.0 [
    30.00        1  11.1 [******
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: POLISH
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00      33  15.8 [********
      7.00      31  14.9 [********
      8.00      43  20.6 [***********
      9.00      29  13.9 [*******
     10.00      15   7.2 [****
     11.00      10   8.6 [*****
     12.00       5   2.4 [**
     13.00       7   3.3 [**
     14.00       6   2.8 [**
     15.00       6   2.8 [**
     16.00       1   0.4 [*
     17.00       2   0.9 [*
     18.00       1   0.4 [*
     19.00       4   1.9 [*
     20.00       1   0.4 [*
     21.00       0   0.0 [
     22.00       2   0.9 [*
     23.00       0   0.0 [
     24.00       1   0.4 [*
     25.00       0   0.0 [
     26.00       0   0.0 [
     27.00       0   0.0 [
     28.00       0   0.0 [
     29.00       1   0.4 [*
     30.00       2   0.9 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00      13   5.9 [***
      7.00      21   9.6 [*****
      8.00      32  14.6 [********
      9.00      20   9.1 [*****
     10.00      17   7.7 [****
     11.00      16   7.3 [****
     12.00      10   4.5 [***
     13.00      13   5.9 [***
     14.00       8   3.6 [**
     15.00       7   3.2 [**
     16.00       9   4.1 [***
     17.00       7   3.2 [**
     18.00      10   4.5 [***
     19.00       8   3.6 [**
     20.00       6   2.7 [**
     21.00       2   0.9 [*
     22.00       5   2.2 [**
     23.00       2   0.9 [*
     24.00       1   0.4 [*
     25.00       1   0.4 [*
     26.00       0   0.0 [
     27.00       3   1.3 [*
     28.00       1   0.4 [*
     29.00       0   0.0 [
     30.00       6   2.7 [**
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      16  16.6 [*********
     7.00      12  12.5 [*******
     8.00      17  17.7 [*********
     9.00       7   7.2 [****
    10.00       6   6.2 [****
    11.00      10  10.4 [******
    12.00       1   1.0 [*
    13.00       4   4.1 [***
    14.00       3   3.1 [**
    15.00       4   4.1 [***
    16.00       1   1.0 [*
    17.00       2   2.0 [**
    18.00       1   1.0 [*
    19.00       1   1.0 [*
    20.00       0   0.0 [
    21.00       4   4.1 [***
    22.00       2   2.0 [**
    23.00       0   0.0 [
    24.00       1   1.0 [*
    25.00       0   0.0 [
    26.00       1   1.0 [*
    27.00       1   1.0 [*
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       2   2.0 [**
```

```
PRC: REP

                                                        MAGNIFICATION=              500
SUMMARY OF RESULTS                                      GUARD REGION=             4.000 microns
                                                        MINIMUM PARTICLE SIZE=    0.500 microns
LABEL: 85-197-P743-20-850-R  500X (.5-7.5)              MAXIMUM PARTICLE SIZE=    7.500 microns
NUMBER OF FRAMES              4                         LOW SHAPE FACTOR=         1.000
NUMBER OF PARTICLES         291                         HIGH SHAPE FACTOR=        7.000
MAGNIFICATION               500
FIELD WIDTH=             179.95 um
OFF PARTICLE SPACING=      0.48 um
ON PARTICLE SPACING=       0.04 um
FIELD AREA=            3.23E+04 um^2
TYPE          NAME                   AVE.DIA.              MAX        MAX/MIN      AREA       PERIMETER
                                     MICRONS             MICRONS                   uM^2       MICRONS
  0  ALL TYPES             1.92E+00 +-  1.27E+00      3.05E+00     2.77E+00   4.426E+00   8.325E+00
  1  PYRITE                1.82E+00 +-  6.15E-01      2.03E+00     1.17E+00   2.918E+00   6.009E+00
  2  KAOLINITE             2.49E+00 +-  1.32E+00      3.28E+00     1.67E+00   6.317E+00   8.844E+00
  3  ILLITE                2.24E+00 +-  1.08E+00      3.53E+00     2.39E+00   5.057E+00   9.283E+00
  4  QUARTZ                3.33E+00 +-  0.00E+00      4.21E+00     1.59E+00   8.939E+00   1.111E+01
  5  SIDERITE              2.53E+00 +-  2.28E+00      3.86E+00     1.81E+00   8.236E+00   9.810E+00
 13  HALITE                3.25E+00 +-  0.00E+00      3.47E+00     1.25E+00   8.335E+00   1.129E+01
 21  FeS (?)               4.35E+00 +-  3.30E+00      5.07E+00     1.24E+00   2.992E+01   1.474E+01
 22  POLISH                2.10E+00 +-  1.29E+00      3.54E+00     3.05E+00   5.159E+00   9.600E+00
 62  NON-INT               1.40E+00 +-  7.53E-01      2.25E+00     2.87E+00   2.135E+00   6.424E+00
 63  UNKNOWN               1.51E+00 +-  9.96E-01      2.30E+00     2.72E+00   2.767E+00   6.437E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                       291    100.00       0.99
  1  PYRITE                            4      1.37       0.00
  2  KAOLINITE                        15      5.15       0.07
  3  ILLITE                            8      2.74       0.03
  4  QUARTZ                            1      0.34       0.00
  5  SIDERITE                          4      1.37       0.02
 13  HALITE                            1      0.34       0.00
 21  FeS (?)                           4      1.37       0.06
 22  POLISH                          138     47.42       0.54
 62  NON-INT                          41     14.08       0.06
 63  UNKNOWN                          75     25.77       0.16

PRC: ANALYZE FRAMES
WOULD YOU LIKE TO STORE DATA TO DISK YES OR NO? Y


                                                            THRESHOLDS:  LOWER=  92  UPPER= 255

   FRAME NO.    1                                           FRAME NO.    2
   TOTAL NO OF PARTICLES FOR FRAME=   83                    TOTAL NO OF PARTICLES FOR FRAME=  167

     THRESHOLDS:  LOWER=  69  UPPER= 255                    THRESHOLDS:  LOWER= 102  UPPER= 255

                                                            FRAME NO.    3
                                                            TOTAL NO OF PARTICLES FOR FRAME=   41

                                                            THRESHOLDS:  LOWER=  98  UPPER= 255
   FILE NO.?25
   DRIVE NO.?2                                              FRAME NO.    4
   LABEL: 74329850\0\5\0\9\2\3\443-20-050R-500              TOTAL NO OF PARTICLES FOR FRAME=    0
```

```
SUMMARY OF RESULTS                                    LABEL: 85-197-P743-20-850-R  500X (.5-7.5)
                                                      MAGNIFICATION=                 500
                                                      GUARD REGION=               4.000 microns
LABEL: 85-197-P743-20-850-R  500X (.5-7.5)            MINIMUM PARTICLE SIZE=      0.500 microns
NUMBER OF FRAMES                 1                    MAXIMUM PARTICLE SIZE=      7.500 microns
NUMBER OF PARTICLES             92                    LOW SHAPE FACTOR=           1.000
MAGNIFICATION                  500                    HIGH SHAPE FACTOR=          7.000
FIELD WIDTH=                179.95 um
OFF PARTICLE SPACING=         0.48 um
ON PARTICLE SPACING=          0.04 um
FIELD AREA=               3.23E+04 um^2
TYPE           NAME                   AVE.DIA.             MAX        MAX/MIN     AREA        PERIMETER
                                      MICRONS              MICRONS                uM^2        MICRONS
  0   ALL TYPES               1.89E+00 +-  1.43E+00   3.10E+00   2.90E+00  4.992E+00  8.065E+00
  2   KAOLINITE               1.88E+00 +-  3.59E-01   2.97E+00   2.47E+00  3.176E+00  7.563E+00
  3   ILLITE                  1.63E+00 +-  7.14E-01   2.61E+00   2.57E+00  2.697E+00  6.574E+00
  4   QUARTZ                  3.09E+00 +-  1.86E+00   5.50E+00   3.07E+00  1.085E+01  1.352E+01
  5   SIDERITE                7.47E-01 +-  0.00E+00   8.78E-01   1.33E+00  4.953E-01  2.680E+00
 21   FeS (?)                 3.47E+00 +-  6.83E-01   4.19E+00   1.50E+00  9.838E+00  1.197E+01
 22   POLISH                  2.19E+00 +-  1.80E+00   3.60E+00   3.31E+00  7.272E+00  9.514E+00
 23   ILLITE + Ti             9.44E-01 +-  4.00E-01   1.84E+00   3.61E+00  9.564E-01  4.790E+00
 62   NON-INT                 1.69E+00 +-  1.02E+00   2.67E+00   2.48E+00  3.237E+00  6.855E+00
 63   UNKNOWN                 1.00E+00 +-  3.37E-01   1.63E+00   2.73E+00  1.007E+00  4.493E+00

PARTICLE COUNT SUMMARY
TYPE           NAME                NUMBER     #(%)     T.AREA(%)
  0   ALL TYPES                      92     100.00        1.41
  2   KAOLINITE                       9       9.78        0.08
  3   ILLITE                         10      10.86        0.08
  4   QUARTZ                          9       9.78        0.30
  5   SIDERITE                        1       1.08        0.00
 21   FeS (?)                         2       2.17        0.06
 22   POLISH                         33      35.86        0.74
 23   ILLITE + Ti                     4       4.34        0.01
 62   NON-INT                         8       8.69        0.07
 63   UNKNOWN                        16      17.39        0.04

PRC: HIS



     THRESHOLDS:  LOWER=  53  UPPER= 255

     FRAME NO.    1
     TOTAL NO OF PARTICLES FOR FRAME=   92


 AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
 BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       4  25.0 [*************
      1.00       5  31.2 [****************
      1.25       3  18.7 [**********
      1.50       3  18.7 [**********
      1.75       0   0.0 [
      2.00       1   6.2 [****
      2.25       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75     13  14.1 [*********
     1.00     14  15.2 [*********
     1.25      8   8.6 [*****
     1.50     13  14.1 [*********
     1.75      3   3.2 [**
     2.00     10  10.8 [*******
     2.25      6   6.5 [****
     2.50      6   6.5 [****
     2.75      4   4.3 [***
     3.00      4   4.3 [***
     3.25      1   1.0 [*
     3.50      0   0.0 [
     3.75      1   1.0 [*
     4.00      2   2.1 [**
     4.25      1   1.0 [*
     4.50      0   0.0 [
     4.75      1   1.0 [*
     5.00      1   1.0 [*
     5.25      0   0.0 [
     5.50      0   0.0 [
     5.75      0   0.0 [
     6.00      1   1.0 [*
     6.25      0   0.0 [
     6.50      0   0.0 [
     6.75      0   0.0 [
     7.00      0   0.0 [
     7.25      1   1.0 [*
     7.50      2   2.1 [**

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      0   0.0 [
     1.25      0   0.0 [
     1.50      2  22.2 [*************
     1.75      0   0.0 [
     2.00      3  33.3 [********************
     2.25      2  22.2 [*************
     2.50      2  22.2 [*************
     2.75      0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25      0   0.0 [
     0.50      0   0.0 [
     0.75      0   0.0 [
     1.00      2  20.0 [************
     1.25      2  20.0 [************
     1.50      1  10.0 [******
     1.75      0   0.0 [
     2.00      3  30.0 [******************
     2.25      0   0.0 [
     2.50      1  10.0 [******
     2.75      0   0.0 [
     3.00      0   0.0 [
     3.25      1  10.0 [******
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1  11.1 [******
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       2  22.2 [************
     2.50       2  22.2 [************
     2.75       1  11.1 [******
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       1  11.1 [******
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       1  11.1 [******
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       1  11.1 [******
     7.50       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1  50.0 [*************************
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       1  50.0 [*************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       5  15.1 [********
     1.00       5  15.1 [********
     1.25       2   6.0 [****
     1.50       3   9.0 [*****
     1.75       2   6.0 [****
     2.00       3   9.0 [*****
     2.25       2   6.0 [****
     2.50       1   3.0 [**
     2.75       3   9.0 [*****
     3.00       2   6.0 [****
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       1   3.0 [**
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       1   3.0 [**
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       1   3.0 [**
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       2   6.0 [****
```

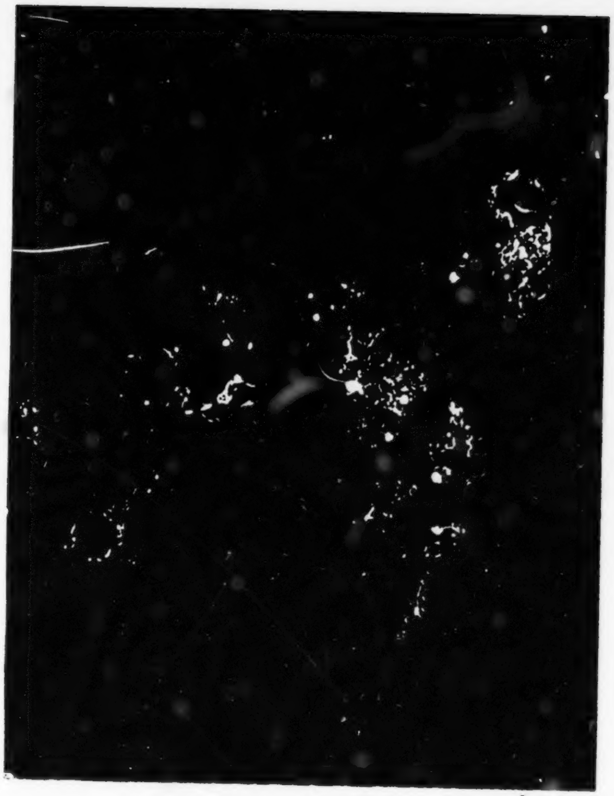
```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2  50.0 [**************************
     1.00       1  25.0 [*************
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       1  25.0 [*************
     2.00       0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       1  12.5 [*******
     1.00       0   0.0 [
     1.25       1  12.5 [*******
     1.50       4  50.0 [**************************
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1  12.5 [*******
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       1  12.5 [*******
     4.00       0   0.0 [
```

PHOTOMICROGRAPH: PLATE #11

Eastern Canadian Coal Ash: -200 mesh coal burned at 1100°C oxidizing atmosphere.

1. 0619-01 35X, BEI, area analysed by automated SEM-EDX-image analysis.



```
PRC: REP

                                                           MAGNIFICATION=                50
                                                           GUARD REGION=             15.000 microns
SUMMARY OF RESULTS                                         MINIMUM PARTICLE SIZE=     5.000 microns
                                                           MAXIMUM PARTICLE SIZE=    30.000 microns
LABEL: 85-197-P743-200 850-0-50X                           LOW SHAPE FACTOR=          1.000
NUMBER OF FRAMES             2                             HIGH SHAPE FACTOR=         7.000
NUMBER OF PARTICLES        619
MAGNIFICATION               50
FIELD WIDTH=           1799.56 um
OFF PARTICLE SPACING=     4.83 um
ON PARTICLE SPACING=      0.43 um
FIELD AREA=        3.23E+06 um^2
TYPE          NAME                  AVE.DIA.                 MAX        MAX/MIN      AREA      PERIMETER
                                    MICRONS                 MICRONS                  uM^2      MICRONS
  0  ALL TYPES               9.65E+00 +-  5.85E+00     1.69E+01    3.90E+00   1.097E+02  4.930E+01
  1  PYRITE                  8.51E+00 +-  2.27E+00     1.25E+01    2.13E+00   6.633E+01  3.610E+01
  2  KAOLINITE               8.25E+00 +-  3.06E+00     1.47E+01    3.18E+00   6.721E+01  3.984E+01
  3  ILLITE                  1.62E+01 +-  2.96E+01     2.18E+01    2.72E+00   8.388E+02  6.764E+01
  4  QUARTZ                  6.59E+00 +-  4.39E-01     9.66E+00    1.99E+00   3.978E+01  2.827E+01
  5  SIDERITE                1.37E+01 +-  3.97E+00     2.06E+01    2.19E+00   1.590E+02  5.572E+01
  6  CALCITE                 2.37E+01 +-  0.00E+00     3.51E+01    2.75E+00   5.363E+02  1.248E+02
 11  GYPSUM                  1.07E+01 +-  5.98E+00     1.88E+01    2.79E+00   1.234E+02  5.108E+01
 15  APATITE                 1.16E+01 +-  3.10E-01     1.36E+01    1.52E+00   1.094E+02  4.064E+01
 18  SPHALERITE              6.59E+00 +-  0.00E+00     9.66E+00    2.75E+00   4.258E+01  3.032E+01
 20  ORGANIC SULPHUR         1.01E+01 +-  0.00E+00     2.02E+01    3.28E+00   8.593E+01  4.702E+01
 21  FeS (?)                 1.13E+01 +-  5.94E+00     1.53E+01    1.91E+00   1.314E+02  4.478E+01
 22  ILLITE + Ti             7.25E+00 +-  9.32E-01     1.49E+01    3.72E+00   5.233E+01  4.020E+01
 24  POLISH                  1.01E+01 +-  3.90E+00     1.72E+01    3.09E+00   1.024E+02  4.999E+01
 62  NON-INT                 9.08E+00 +-  3.36E+00     1.70E+01    4.72E+00   8.450E+01  4.985E+01
 63  UNKNOWN                 9.70E+00 +-  4.89E+00     1.71E+01    3.59E+00   1.034E+02  4.922E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                       619     100.00       1.04
  1  PYRITE                           13       2.10       0.01
  2  KAOLINITE                        18       2.90       0.01
  3  ILLITE                           13       2.10       0.16
  4  QUARTZ                            3       0.48       0.00
  5  SIDERITE                          5       0.80       0.01
  6  CALCITE                           1       0.16       0.00
 11  GYPSUM                            4       0.64       0.00
 15  APATITE                           2       0.32       0.00
 18  SPHALERITE                        1       0.16       0.00
 20  ORGANIC SULPHUR                   1       0.16       0.00
 21  FeS (?)                          22       3.55       0.04
 22  ILLITE + Ti                       2       0.32       0.00
 24  POLISH                           85      13.73       0.13
 62  NON-INT                         291      47.01       0.37
 63  UNKNOWN                         158      25.52       0.25

                                                        THRESHOLDS:  LOWER=  49  UPPER= 255

      FILE NO.?29                                       FRAME NO.     1
      DRIVE NO.?2                                       TOTAL NO OF PARTICLES FOR FRAME=  345
      LABEL: P743-200-850-0-50X
      NO. OF VIDEO SAMPLES   32?                        FRAME NO.     2
                                                        TOTAL NO OF PARTICLES FOR FRAME=  274
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00      80  12.9 [*******
     7.00      90  14.5 [********
     8.00     120  19.3 [**********
     9.00      67  10.8 [******
    10.00      52   8.4 [*****
    11.00      66  10.6 [******
    12.00      28   4.5 [***
    13.00      21   3.3 [**
    14.00      14   2.2 [**
    15.00      21   3.3 [**
    16.00      12   1.9 [*
    17.00       8   1.2 [*
    18.00       8   1.2 [*
    19.00      13   2.1 [**
    20.00       6   0.9 [*
    21.00       0   0.0 [
    22.00       2   0.3 [*
    23.00       2   0.3 [*
    24.00       3   0.4 [*
    25.00       1   0.1 [*
    26.00       2   0.3 [*
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       3   0.4 [*

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       2  15.3 [********
     7.00       3  23.0 [************
     8.00       0   0.0 [
     9.00       2  15.3 [********
    10.00       2  15.3 [********
    11.00       2  15.3 [********
    12.00       1   7.6 [****
    13.00       1   7.6 [****
    14.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)   NO.   %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       1  20.0 [***********
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       2  40.0 [*********************
    16.00       0   0.0 [
    17.00       1  20.0 [***********
    18.00       1  20.0 [***********

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)   NO.   %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       1 100.0 [***************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       3  16.6 [*********
     7.00       6  33.3 [*****************
     8.00       3  16.6 [*********
     9.00       1   5.5 [***
    10.00       1   5.5 [***
    11.00       1   5.5 [***
    12.00       0   0.0 [
    13.00       1   5.5 [***
    14.00       0   0.0 [
    15.00       1   5.5 [***
    16.00       1   5.5 [***
    17.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       5  38.4 [********************
     7.00       2  15.3 [********
     8.00       1   7.6 [****
     9.00       1   7.6 [****
    10.00       0   0.0 [
    11.00       1   7.6 [****
    12.00       0   0.0 [
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       1   7.6 [****
    16.00       0   0.0 [
    17.00       1   7.6 [****
    18.00       0   0.0 [
    19.00       0   0.0 [
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       0   0.0 [
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   7.6 [****

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       2  66.6 [**********************************
     8.00       1  33.3 [*****************
     9.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       1  25.0 [*************
     7.00       0   0.0 [
     8.00       1  25.0 [*************
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       1  25.0 [*************
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       0   0.0 [
    18.00       0   0.0 [
    19.00       1  25.0 [*************
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       0   0.0 [
    12.00       2 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  18   NAME: SPHALERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       0   0.0 [
     7.00       0   0.0 [
     8.00       0   0.0 [
     9.00       0   0.0 [
    10.00       0   0.0 [
    11.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     1.00       0   0.0 [
     2.00       0   0.0 [
     3.00       0   0.0 [
     4.00       0   0.0 [
     5.00       0   0.0 [
     6.00       3  13.6 [*******
     7.00       1   4.5 [***
     8.00       3  13.6 [*******
     9.00       3  13.6 [*******
    10.00       2   9.0 [*****
    11.00       3  13.6 [*******
    12.00       2   9.0 [*****
    13.00       0   0.0 [
    14.00       0   0.0 [
    15.00       0   0.0 [
    16.00       0   0.0 [
    17.00       1   4.5 [***
    18.00       1   4.5 [***
    19.00       1   4.5 [***
    20.00       0   0.0 [
    21.00       0   0.0 [
    22.00       0   0.0 [
    23.00       1   4.5 [***
    24.00       0   0.0 [
    25.00       0   0.0 [
    26.00       0   0.0 [
    27.00       0   0.0 [
    28.00       0   0.0 [
    29.00       0   0.0 [
    30.00       1   4.5 [***
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00       0   0.0 [
      7.00       1  50.0 [**************************
      8.00       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      1.00       0   0.0 [
      2.00       0   0.0 [
      3.00       0   0.0 [
      4.00       0   0.0 [
      5.00       0   0.0 [
      6.00       7   8.2 [*****
      7.00       5   5.8 [***
      8.00      22  25.8 [*************
      9.00       6   7.0 [****
     10.00      10  11.7 [******
     11.00      12  14.1 [********
     12.00       3   3.5 [**
     13.00       1   1.1 [*
     14.00       3   3.5 [**
     15.00       5   5.8 [***
     16.00       3   3.5 [**
     17.00       1   1.1 [*
     18.00       1   1.1 [*
     19.00       2   2.3 [**
     20.00       3   3.5 [**
     21.00       0   0.0 [
     22.00       0   0.0 [
     23.00       0   0.0 [
     24.00       1   1.1 [*
     25.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       35  12.0 [********
     7.00       45  15.4 [*********
     8.00       60  20.6 [************
     9.00       39  13.4 [********
    10.00       27   9.2 [*****
    11.00       27   9.2 [*****
    12.00       11   3.7 [**
    13.00        9   3.0 [**
    14.00       11   3.7 [**
    15.00        9   3.0 [**
    16.00        3   1.0 [*
    17.00        3   1.0 [*
    18.00        3   1.0 [*
    19.00        4   1.3 [*
    20.00        3   1.0 [*
    21.00        0   0.0 [
    22.00        1   0.3 [*
    23.00        0   0.0 [
    24.00        0   0.0 [
    25.00        0   0.0 [
    26.00        1   0.3 [*
    27.00        0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     1.00        0   0.0 [
     2.00        0   0.0 [
     3.00        0   0.0 [
     4.00        0   0.0 [
     5.00        0   0.0 [
     6.00       24  15.1 [*********
     7.00       24  15.1 [*********
     8.00       27  17.0 [**********
     9.00       15   9.4 [*****
    10.00       10   6.3 [****
    11.00       19  12.0 [*******
    12.00        8   5.0 [***
    13.00        9   5.6 [***
    14.00        0   0.0 [
    15.00        3   1.8 [*
    16.00        5   3.1 [**
    17.00        1   0.6 [*
    18.00        2   1.2 [*
    19.00        5   3.1 [**
    20.00        0   0.0 [
    21.00        0   0.0 [
    22.00        1   0.6 [*
    23.00        1   0.6 [*
    24.00        1   0.6 [*
    25.00        1   0.6 [*
    26.00        1   0.6 [*
    27.00        0   0.0 [
    28.00        0   0.0 [
    29.00        0   0.0 [
    30.00        1   0.6 [*
```

```
SUMMARY OF RESULTS

LABEL: 85-197-P743-200-850-0-500X                    MAGNIFICATION=               500
NUMBER OF FRAMES              2                      GUARD REGION=              4.000 microns
NUMBER OF PARTICLES         498                      MINIMUM PARTICLE SIZE=     0.500 microns
MAGNIFICATION               500                      MAXIMUM PARTICLE SIZE=     7.500 microns
FIELD WIDTH=             179.95 um                   LOW SHAPE FACTOR=          1.000
OFF PARTICLE SPACING=      0.48 um                   HIGH SHAPE FACTOR=         7.000
ON PARTICLE SPACING=       0.04 um
FIELD AREA=            3.23E+04 um^2
TYPE          NAME                  AVE.DIA.              MAX        MAX/MIN      AREA       PERIMETER
                                    MICRONS              MICRONS                  uM^2       MICRONS
  0   ALL TYPES             2.33E+00 +-  2.29E+00     4.03E+00    3.69E+00  9.304E+00  1.108E+01
  1   PYRITE                1.86E+00 +-  1.84E+00     3.14E+00    1.72E+00  5.365E+00  8.469E+00
  2   KAOLINITE             3.81E+00 +-  4.50E+00     4.92E+00    1.71E+00  2.585E+01  1.440E+01
  3   ILLITE                1.85E+00 +-  5.66E-01     2.77E+00    2.16E+00  3.156E+00  7.331E+00
  4   QUARTZ                2.98E+00 +-  0.00E+00     3.82E+00    1.58E+00  7.100E+00  1.001E+01
  5   SIDERITE              1.12E+01 +-  5.84E+00     1.43E+01    1.46E+00  1.167E+02  4.201E+01
 10   SMECTITE              9.22E-01 +-  0.00E+00     1.36E+00    1.82E+00  7.299E-01  3.559E+00
 14   RUTILE                1.27E+00 +-  0.00E+00     1.49E+00    1.41E+00  1.318E+00  4.438E+00
 16   MONAZITE              2.48E+00 +-  1.46E+00     4.15E+00    2.35E+00  6.026E+00  1.063E+01
 19   CHALCOPYRITE          1.34E+00 +-  1.00E+00     1.91E+00    1.82E+00  2.172E+00  5.211E+00
 21   FeS (?)               5.14E+00 +-  4.24E+00     7.95E+00    2.34E+00  3.480E+01  2.062E+01
 22   ILLITE + Ti           1.47E+00 +-  4.15E-01     3.42E+00    6.45E+00  2.097E+00  8.159E+00
 23   ZIRCON                2.31E+00 +-  2.86E+00     4.86E+00    2.07E+00  8.904E+00  1.210E+01
 24   POLISH                3.32E+00 +-  2.89E+00     5.63E+00    3.45E+00  1.713E+01  1.563E+01
 62   NON-INT               1.86E+00 +-  1.47E+00     3.52E+00    5.02E+00  5.111E+00  9.792E+00
 63   UNKNOWN               2.00E+00 +-  1.80E+00     3.41E+00    2.94E+00  6.350E+00  9.372E+00

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER     #(%)      T.AREA(%)
  0   ALL TYPES                     498     100.00        7.15
  1   PYRITE                         11       2.20        0.09
  2   KAOLINITE                       7       1.40        0.27
  3   ILLITE                          6       1.20        0.02
  4   QUARTZ                          1       0.20        0.01
  5   SIDERITE                        2       0.40        0.36
 10   SMECTITE                        1       0.20        0.00
 14   RUTILE                          1       0.20        0.00
 16   MONAZITE                        2       0.40        0.01
 19   CHALCOPYRITE                    5       1.00        0.01
 21   FeS (?)                        17       3.41        0.91
 22   ILLITE + Ti                     3       0.60        0.00
 23   ZIRCON                          3       0.60        0.04
 24   POLISH                         85      17.06        2.24
 62   NON-INT                       178      35.74        1.48
 63   UNKNOWN                       176      35.34        1.72


                                                     THRESHOLDS:  LOWER=  57  UPPER= 255

                                                     FRAME NO.    1
      FILE NO.?33                                    TOTAL NO OF PARTICLES FOR FRAME=  252
      LABEL: P743-200-850-0-500X
      NO. OF VIDEO SAMPLES   32?                     FRAME NO.    2
                                                     TOTAL NO OF PARTICLES FOR FRAME=  246
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      79  15.8 [********
     1.00      63  12.6 [*******
     1.25      60  12.0 [*******
     1.50      53  10.6 [******
     1.75      31   6.2 [****
     2.00      32   6.4 [****
     2.25      19   3.8 [**
     2.50      14   2.8 [**
     2.75      18   3.6 [**
     3.00      16   3.2 [**
     3.25       9   1.8 [*
     3.50      12   2.4 [**
     3.75      13   2.6 [**
     4.00       8   1.6 [*
     4.25       6   1.2 [*
     4.50       7   1.4 [*
     4.75       2   0.4 [*
     5.00       3   0.6 [*
     5.25       3   0.6 [*
     5.50       4   0.8 [*
     5.75       3   0.6 [*
     6.00       4   0.8 [*
     6.25       4   0.8 [*
     6.50       3   0.6 [*
     6.75       4   0.8 [*
     7.00       1   0.2 [*
     7.25       3   0.6 [*
     7.50      24   4.8 [***

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1   9.0 [*****
     1.25       7  63.6 [********************************
     1.50       0   0.0 [
     1.75       1   9.0 [*****
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       1   9.0 [*****
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       1   9.0 [*****
     7.50       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       1  14.2 [********
      1.00       0   0.0 [
      1.25       0   0.0 [
      1.50       1  14.2 [********
      1.75       0   0.0 [
      2.00       1  14.2 [********
      2.25       1  14.2 [********
      2.50       0   0.0 [
      2.75       1  14.2 [********
      3.00       0   0.0 [
      3.25       0   0.0 [
      3.50       0   0.0 [
      3.75       0   0.0 [
      4.00       0   0.0 [
      4.25       0   0.0 [
      4.50       0   0.0 [
      4.75       1  14.2 [********
      5.00       0   0.0 [
      5.25       0   0.0 [
      5.50       0   0.0 [
      5.75       0   0.0 [
      6.00       0   0.0 [
      6.25       0   0.0 [
      6.50       0   0.0 [
      6.75       0   0.0 [
      7.00       0   0.0 [
      7.25       0   0.0 [
      7.50       1  14.2 [********
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       0   0.0 [
      1.00       0   0.0 [
      1.25       1  16.6 [*********
      1.50       1  16.6 [*********
      1.75       0   0.0 [
      2.00       1  16.6 [*********
      2.25       1  16.6 [*********
      2.50       2  33.3 [*****************
      2.75       0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      0.25       0   0.0 [
      0.50       0   0.0 [
      0.75       0   0.0 [
      1.00       0   0.0 [
      1.25       0   0.0 [
      1.50       0   0.0 [
      1.75       0   0.0 [
      2.00       0   0.0 [
      2.25       0   0.0 [
      2.50       0   0.0 [
      2.75       0   0.0 [
      3.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       0   0.0 [
     6.25       0   0.0 [
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       1  50.0 [*************************
     7.50       1  50.0 [*************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  10   NAME: SMECTITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       1  50.0 [**************************
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       1  50.0 [**************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  19   NAME: CHALCOPYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2  40.0 [*********************
     1.00       1  20.0 [***********
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       1  20.0 [***********
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       1  20.0 [***********
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       1   5.8 [***
     1.00       0   0.0 [
     1.25       3  17.6 [*********
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       1   5.8 [***
     2.50       0   0.0 [
     2.75       2  11.7 [******
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       1   5.8 [***
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       1   5.8 [***
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       1   5.8 [***
     5.50       0   0.0 [
     5.75       1   5.8 [***
     6.00       1   5.8 [***
     6.25       1   5.8 [***
     6.50       0   0.0 [
     6.75       0   0.0 [
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       4  23.5 [************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       0   0.0 [
     1.00       0   0.0 [
     1.25       1  33.3 [*****************
     1.50       0   0.0 [
     1.75       1  33.3 [*****************
     2.00       1  33.3 [*****************
     2.25       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75       2  66.6 [*********************************
     1.00       0   0.0 [
     1.25       0   0.0 [
     1.50       0   0.0 [
     1.75       0   0.0 [
     2.00       0   0.0 [
     2.25       0   0.0 [
     2.50       0   0.0 [
     2.75       0   0.0 [
     3.00       0   0.0 [
     3.25       0   0.0 [
     3.50       0   0.0 [
     3.75       0   0.0 [
     4.00       0   0.0 [
     4.25       0   0.0 [
     4.50       0   0.0 [
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       0   0.0 [
     5.50       0   0.0 [
     5.75       1  33.3 [*****************
     6.00       0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      10  11.7 [******
     1.00       9  10.5 [******
     1.25       4   4.7 [***
     1.50       7   8.2 [*****
     1.75       2   2.3 [**
     2.00       7   8.2 [*****
     2.25       3   3.5 [**
     2.50       1   1.1 [*
     2.75       5   5.8 [***
     3.00       5   5.8 [***
     3.25       2   2.3 [**
     3.50       4   4.7 [***
     3.75       1   1.1 [*
     4.00       2   2.3 [**
     4.25       2   2.3 [**
     4.50       2   2.3 [**
     4.75       0   0.0 [
     5.00       0   0.0 [
     5.25       1   1.1 [*
     5.50       0   0.0 [
     5.75       0   0.0 [
     6.00       2   2.3 [**
     6.25       1   1.1 [*
     6.50       0   0.0 [
     6.75       2   2.3 [**
     7.00       1   1.1 [*
     7.25       0   0.0 [
     7.50      12  14.1 [********
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      29  16.2 [**********
     1.00      26  14.6 [*********
     1.25      27  15.1 [*********
     1.50      22  12.3 [*******
     1.75      15   8.4 [*****
     2.00       7   3.9 [**
     2.25       8   4.4 [***
     2.50       5   2.8 [**
     2.75       6   3.3 [**
     3.00       4   2.2 [**
     3.25       3   1.6 [*
     3.50       4   2.2 [**
     3.75       4   2.2 [**
     4.00       2   1.1 [*
     4.25       1   0.5 [*
     4.50       3   1.6 [*
     4.75       1   0.5 [*
     5.00       2   1.1 [*
     5.25       0   0.0 [
     5.50       2   1.1 [*
     5.75       1   0.5 [*
     6.00       0   0.0 [
     6.25       1   0.5 [*
     6.50       1   0.5 [*
     6.75       1   0.5 [*
     7.00       0   0.0 [
     7.25       1   0.5 [*
     7.50       2   1.1 [*
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     0.25       0   0.0 [
     0.50       0   0.0 [
     0.75      34  19.3 [***********
     1.00      25  14.2 [********
     1.25      17   9.6 [*****
     1.50      20  11.3 [******
     1.75      11   6.2 [****
     2.00      15   8.5 [*****
     2.25       5   2.8 [**
     2.50       6   3.4 [**
     2.75       4   2.2 [**
     3.00       5   2.8 [**
     3.25       4   2.2 [**
     3.50       2   1.1 [*
     3.75       7   3.9 [**
     4.00       4   2.2 [**
     4.25       2   1.1 [*
     4.50       2   1.1 [*
     4.75       0   0.0 [
     5.00       1   0.5 [*
     5.25       1   0.5 [*
     5.50       2   1.1 [*
     5.75       0   0.0 [
     6.00       1   0.5 [*
     6.25       1   0.5 [*
     6.50       2   1.1 [*
     6.75       1   0.5 [*
     7.00       0   0.0 [
     7.25       0   0.0 [
     7.50       4   2.2 [**
```